

Nailsea and District Croquet Club
Minutes of Committee Meeting held on 27th May 2021

Present: G MaCausland, A Wimshurst, D Hunt, B Roynon, P Dyke, S Morgan, E Malaiperuman.

Minutes of last meeting: Agreed (change of wording in Fixture's report) and signed by EM on behalf of GmcM

Matters arising: Date for Secretary's Shield set for Tuesday 29th. Away in at Edgebaston CC

Treasure's Report: Noted and discussed.

Membership Report: A healthy return, We have 6 new full members so far and those coaching are doing an excellent job getting people to sign up. there may be more to come. All those who wanted keys have them, but we need some more, which Brian has in hand.

Associate :1 Country: 2 Junior:3 Full:66 Social:6 Life: 7 . In total 72 **playing** members.
New members' emails have been added to the list.

Property Report. Noted and discussed. **Brian** to order new trolley wheels ready for future repairs.

Work mornings will be organised prior to CA matches, as follows

Thursday 17th June : Friday 16th July: August 12th

Brian also prososed that he should peg down the spare piece of plastic grid to cover that part of the carpark which has been damaged by flood and mud.

New blank keys will soon be available.

Recruitment Report: noted and discussed. Many thanks to Linda, John Hancock, Martin and Kathy for all their hard work. It was agreed that the integration of new players into the club was extremely important and was an ongoing discussion.

All Kathy's questions were discussed. **Erica** to inform Kathy.

Fixture's Report: Noted and discussed. There is still concern over the missing SWF trophy, Peter will continue to contact other team memebers.

Safeguarding Report: Linda's report was noted and the committee agreed to it. **Graham** to contact Linda, as requested. Her report will be posted on the website with the original policy. **Erica**

Lawns Report: noted and discussed. As always we are indebted to the huge amount of work undertaken by John. We have received very good reports from players about the quality of the lawns, Marcus Evan was especially impressed. We agreed that we should ask **John** to go ahead with organising tenders for the work required for installing irrigation. A timeslot for the work would be arranged, preferably in the early Spring of 2022.

A.O.B.: Kathy is liasing with Bristol over a joint team for the All England Golf competition.

Handicapping Committee: There have been 2 recent resignations (Pat and David Hunt) from the AC Handicap committee, plus a delayed resignation from Jim. Brian Roynon has very kindly agreed to join Peter and Erica as a 3rd member of the Handicap AC committee.

Clubhouse Cleaning: Joan has reported to the committee her consternation about the state of the clubhouse, and also of the clubhouse not being satisfactorily checked by the last member to lock the clubhouse, leading to running water, food spillages and the state of the gents' loos.

After discussion it was agreed that once again Graham would have to remind members in his update of their responsibilities. It was felt that it was beyond the call of duty to expect Joan to spend her time cleaning up after others. Members would also be called upon to sign up for the cleaning rota.

It was discussed whether or not we should employ a cleaner. **Andrew** pointed out that by checking out the number of members we have at the moment that the subs would have to be raised by £15 in order to pay for a cleaner. The members should also understand that hiring a cleaner would inevitably mean an increase in annual subscription.

It was decided that **Sandra**, in the meantime, should contact Joan and sort out a suitable advert and investigate how potential cleaners who might be local to the club might be found.

Fixtures Secretary: Peter explained that he had someone in mind to replace him and would let the committee know.

Winter play. Graham explained that as things stand with John the lawns will be closed after the finals for a short time. After which they will be open (weather dependent). Complete details of how many lawns will be open and for how long, will be discussed at a further date.

D.O.N.M: June 24th 10.00. Zoom meeting.

The meeting finished at 11.49

Signed as a true and accurate account

Name.....

Signature.....

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Treasurer's report 27th May 2021

The attached Income and expenditure account shows available funds at 25 May 2021 to be £27,676.04. To this needs to be added the receipts from the recent OBE tournament which amount to approximately £100.00.

The Club has been awarded a Covid Restart Grant of £8000 which appears under the heading "raffles donations grants". I cannot take any congratulations for the award, no case had to be made merely an assertion that we qualified for consideration.

The seemingly healthy state of the club finances is a little misleading. We have received the following grants:

14/12/2017	5000	CA Lawns improvement
03/07/2020	10000	N Som
25/05/2021	8000	N Som Covid restart

Total	23000	
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The regular income and expenditure of the club is roughly in equilibrium. We require to carry forward a healthy contingency from year to year .

Never the less the recent grant of £8000 does give the committee the ability to actively consider if and how to proceed with the proposed irrigation system.

David

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Recruitment Report for May Meeting

Lessons have been going well. Three of the five in Linda's Tuesday class have joined the Club and two of the four in John Hancock's Saturday morning class have joined the Club. Linda and John are continuing beyond the six lessons for those who have joined and there are plans to get them all together and for them to get involved with other Club members. My own Friday class of six is still continuing and I am hopeful that some will join in due course. Martin Kerly has a class of four which includes two absolute beginners and two recruits from 2019 who will benefit from more tuition. Again there is optimism about gaining new members. When all the lessons have run their course, we will have joint sessions of varying content and hope to build on an excellent start.

I hope to arrange a joint session with Nailsea Bowls Club if Restrictions are further eased. We could play a hybrid game with a jack but using mallets and croquet balls.

The Scouts visits are in hand and I am delighted that Marcus can attend all three sessions and Ryan the first two. Graham and Pete Longden (an ex Scout leader) will also help.

Kathy Wallace 18-5-21

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Tournaments and Competitions Report for May meeting 2021

Tournaments

The June Tournament is coming soon. We still have one vacancy which I will hope to fill by appealing on Notts List and also to the Cheltenham Club. As far as Covid is concerned, I have put a few thoughts together:

We want to avoid congestion in any single area. So I will publish matches and lawns schedule for the first day by email two days before tournament

Briefing will be sent by e-mail at same time as schedule. Possible short briefing outside if weather OK

Publish second day morning schedule by email on the Sat evening. Convey afternoon schedule in a socially distanced way – detail weather dependent. Could be by text if necessary.

Manager's table in machine room with outside door open if bad weather – otherwise outside

Text results if possible – to me or my assistant if I have one. Results could be phoned if I have an assistant who isn't playing. I hope to have one!

Ask players to bring masks to wear whenever indoors

I will have multiple bottles of alcohol-based hand gel in bottles with dispenser pumps by every lawn. This should mean that we don't need to continually clean balls and clips.

Keep clubhouse doors open and also windows open in changing rooms and toilets

Ask players to bring umbrellas

Use clubhouse for shelter (2 players inside at windows, 2 outside)

Use summer-house decking for shelter (2 players) plus under trees and own umbrellas or cars if necessary in extreme rain

I suggest they bring their own lunch – give them postcodes for Budgens, Tesco and Waitrose. I have not discussed this with Libby.

I will organise a rota of people to help set up and put away in a socially distanced manner.

Questions

1. Can we serve coffee, tea and cake through window? Charge £4 for the weekend. Payable by BACS or cheque.
2. If answer to question 1. is yes, should they bring their own mugs? Alternative: Should we buy some disposable cups suitable for hot drinks?
3. Can we provide chairs or should they bring their own? We don't want multiple people rushing in with dozens of chairs because it's raining but we could tell them to just leave them outside.
4. Who is going to sanitise toilets regularly? Wipe down all door handles in communal areas?
5. Do we need to have signage for queues for toilets?
6. I would like to leave the corner flags and yardline markers out overnight on the Sat/Sun. We will be there and on guard until nearly dark and it saves an awful lot of time as well as lowering risk of potential cross-contamination. Any objections from the Committee?

The GC Home Internationals

There is still a question mark about whether or not the Irish team will be able to travel to England but they have given their agreement to a 3-way tie if necessary. I have agreed with Ian Burrige that if that were to be the case, they would still hire all 4 lawns. This seems fair as our members would not feel comfortable using a lawn with the Internationals taking place on the other lawns and it would give the manager more flexibility and require less double-banking. Whether or not we offer lunches will depend on the progress of the Road map and how members feel about the situation by then.

Competitions

I am still keeping the hard copies of the results sheets at home and maintaining them on the website. This is tedious in the extreme but it does pre-empt members crowding round the notice boards.

On an amusing note, I thought I'd heard everything but this was a new one. A player reported a 26 point AC result as 18-12. On further questioning, (because an impartial observer was suspicious) the winner reported that they had played two one-hour games and added the scores together. As there was a large number of bisques involved, this didn't seem very fair. A rematch has been arranged with the correct format made clear to both parties.

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Property Report

**for Committee Meeting
27th May 2021**

Compost / grass cutting area North West corner

Tony Willoughby was asked to make a fixed containment board to prevent the compost/grass cuttings creeping out towards lawn 3.
Being Tony no sooner the request and it was done!

Work Morning

A work morning was held at the end of April to tidy up the outfield and car parks. A limited number of members were asked to help as most of the work required using machinery. Some members have approached me to say they had not been informed and would have been willing to attend. I explained that the amount of work to be done without machinery was small and that due to the current restrictions and social distancing too many people may have been "an embarrassment of riches".

The club look so much better afterwards so thank you to all those that attended and those that would have come.

Pavillion Keys

New key blanks have been ordered and keys will be cut when they come in.

Trolley Maintenance.

One of the trolley wheels shattered and collapsed and had to be replaced. I only have one spare now and I can see another wheel will need to be replaced in the near future. With the Committees approval I will source and purchase some more pairs of spare wheels.

Fixture Secretary's Report for the meeting on 27 May, 2021.

League Fixtures

There have been a few changes to our Advanced League Division 1 fixtures.

We will now play Taunton Deane on Saturday 3 July instead of Sunday 4 July.

The East Dorset fixture will now take place on Sunday, 4 July, instead of Saturday 17 July.

The match against Bristol was played on Sunday, 23 May, instead of Saturday 22.

Advanced League (Division 1) result: Nailsea 0 Bristol 6 The fixture was abandoned after two rounds as Bristol had already won the match and rain threatened to interrupt the final round.

SWF Trophy

I have spoken to James who has no idea of the whereabouts of the missing trophy – a Claret Jug. He suggested I tried other members of the team – Jim Gregory, Ryan Cabble, Brian McCausland and Graham McCausland. I have spoken to Jim who also has no idea where the trophy is. I have yet to contact the other members of the team.

James Galpin

James will be playing in both the Home Internationals (AC and GC). The Irish have withdrawn from the AC Home International due to take place at East Dorset on 12-13 June and their team has been replaced by a CA U25 team for which James has been picked. In the GC Home International at Nailsea on 17-18 June James has been selected to play for England in his own right.

Peter Dyke
(26/05/2021)

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Lawn Maintenance Report – April 2021

1. Lawns

As figure 1 shows rainfall has increased dramatically with about 169mm of rain falling between May 1 and May 25 compared with 14mm in April. This is more than four times higher than normal and has left the soil prone to minor surface flooding if heavy rainfall occurs. After rainfalls stops it appears to take about 12 hours for surface water to clear. This is primarily a characteristic of the silt/clay soil we have. It's a nuisance when it is wet but it does have the merit of retaining moisture during dry weather.

Many people have commented on the improved sward density. This is probably down to several factors including fertiliser programme revisions but the overseeding with Bent last Autumn does appear to be a major factor. Sadly, the annual meadow grass has also greened up with the increased rainfall.

The positive impact of the Bent overseed, particularly on Lawns 3 & 4, means that the need for a further overseed in the Autumn is clear. To that end, I hope to overseed Lawn 5 using my home-made overseeder and irrigate it for two or three weeks in the evenings. If that is successful, I hope to avoid the cost of a Dynaseeder – fingers crossed! I suspect that regular irrigation is an important part of germinating Bent seed. The sample pots that I sowed in my garden have just germinated in the last week. These were sown the day (February 26) I overseeded Lawns 1 & 2 and have shown no sign of germinating during dry March and April weather. There is therefore a chance that some of the Bent seed on Lawns 1 & 2 is starting to germinate. The seedlings are very fine so its impossible to see them at present but come the Autumn they might become more obvious.

2. Fertiliser programme

One of the benefits of the recent rain is that I can apply fertiliser, Revolution and other soil amendments without having to irrigate.!

3. Weeds and Moss

The Autumn Praxys herbicide spray has killed off most of the weeds that were present. However, Pearlwort and Lesser Trefoil are beginning to reappear so another Praxys spray will be required in early June. We have the chemical but it requires a supervised spray which will cost us £54. Greensleeves will only turn up at the end of their working day so the lawns will need to be closed around 3pm and stay closed for the rest of the day for Health & Safety reasons.

4. Automatic Irrigation

I have circulated an update document relating to the cost of an Automatic irrigation system. The cost of a technically feasible design is estimated to be in the Region of £10,000.

JNW, 25/5/21

Figure 1 Rainfall and ET

NDCC Automatic Irrigation – Design Note 1

1. Introduction
2. Summary of key design decisions
3. Pumps
4. Sprinkler and Piping Layout
5. Sprinkler selection
 - 5.1 Types of Sprinkler
 - 5.2 Selection for 6 Sprinkler systems
 - 5.3 Selection for 8 Sprinkler systems
6. Valves and Swing Joints
7. Tank
 - 7.1 Tank Sizing
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8. Control and Protection Equipment
 - 8.1 Pump Control panels
 - 8.2 8.2 Programmable timers
9. Concrete Plinth contract
10. Electrical Contract
11. Installation Contract
12. Cost estimates

1. Introduction

Last Autumn I produced an initial assessment of the feasibility regarding automatic irrigation at NDCC and circulated it to LAG members. At last month's meeting the committee identified the need to establish likely costs before making any decision on proceeding with such an arrangement. David Hunt then circulated the feasibility study to committee members as it had some preliminary costs in it.

In response to the request for a cost estimate I have revisited the design and costing exercise by:

- a. Identifying candidate contractors and holding preliminary consultation with them
- b. Identifying practical constraints and maintenance issues.
- c. Simplifying the interfaces between contracts.
- d. Reviewing and simplifying the design with a view to minimising equipment cost.
- e. Updating cost estimates in the light of the above.

This design note documents my findings to date. The key decisions I have made in preparing a costed design are outlined in section 2. Sections 3-11 discuss the detail whilst section 12 summarises the possible costs.

2. Summary of key design decisions

In reviewing and updating my initial thoughts on an automatic irrigation system I have made the following design and installation decisions:

- a. A submersible pump will be employed, eliminating several pipework and installation issues.
- b. The tank will be filled from the existing 32mm mains connection outside the machine room using a removable 32mm hosepipe. This eliminates plumbing to water services from the contract.
- c. The tank will be sited on a concrete base located just beyond the drain pipe that empties into the ditch outside the machine room.
- d. The concrete base will be supplied under a separate contract with a local ground-works contractor. This is both cost-effective and ensures that the base is ready to support the tank at the start of the installation contract.
- e. To avoid interference from the stop nets, full circle sprinklers will be replaced by dual part (half) circle sprinklers. For the same reason, sprinklers located at the end of the nets need to be located at about 0.5m back from the net end to allow the jet to clear the net. These net constraints have an impact on the sprinkler configurations.
- f. The mains electrical work within the pavilion will be carried out by a local approved electrical contractor. A new separate power cable will be supplied and terminated in the machine room close to where the contractors pump control panel is to be situated. This work will involve modification to the existing electricity supply board and may require total board replacement. If a programmable controller is to be installed in the pavilion (gents?) low voltage (24VAC) cabling within the pavilion the cable laying will be carried out by NDCC
- g. The installation contractor will only be required to make electrical (mains and signal) connections within the machine room. They will be required to lay all cables outside the machine room in compliance with IET regulations.
- h. The pump control panel and programmable timer control panels are both available in waterproof (IP65) form so they may be mounted on the outside wall of the machine room above the bike stand or inside the machine room/pavilion.
- i. The trenching option is probably best included in the installation. The reason for this is that some installers have the capability of mole trenching which they claim is about 40% quicker than trenching and backfilling/making good. The mole plough is pulled by a tractor which also pulls the pipe into place. The big advantage of mole trenching is that there is relatively little surface disturbance. This could be useful, not only because of immediate cost savings on trenching but because it opens up the possibility of Direct piping as well as Ringmain piping. This is discussed in section 4.

3. Pumps

A neat 4 sprinkler arrangement described in my original proposal is employed in bowling green irrigation systems. However, it requires sufficient high pressure and flow from the pump to achieve around 26m radius of operation from the sprinklers. Typically, the sprinklers able to deliver such distances of throw typically require 9 or 10 m³/hr flow at a pump pressure of 6.5-7.0 bar. Only a few of the single-phase pumps, including 2.2kW versions, are able to come close to meeting this performance requirement.

By contrast, for the 8 sprinkler configuration a radius of 21m yields satisfactory lawn coverage with about a 1m margin (i.e. an absolute minimum of 20m). To achieve a 21m radius the pump needs to be capable of supplying about 5.5 to 6 bar pressure at a flow rate of 5 to 7 m³/hour. There are three types of pumps employed in irrigation systems that are capable of meeting these requirements. The selection is limited by the fact that only a single-phase mains supply is available and all the pumps operate at either 1.5 kW or 2.2 kW. The three types are:

- a. *Horizontal multistage pumps*

Examples include the Ebara Matrix 10-6 (£743) and Lowara 10-05HMP (£1045)

b. *Vertical multistage pumps*

Examples include the Lowara 5SV11 (£1526). These pumps tend to be more expensive than horizontal pumps

c. *Submersible pumps*

Examples include Lowara SCUBA 8SC6 (£1006), Grundfos SP9-11 (£1693) and Caprari E4XED40-12 (£683).

The horizontal and vertical pumps are difficult to install in the machine room because of space and piping routes to the tank. The submersible pumps are sited (horizontally) in the tank and require no pipework to/from the machine room. They are designed to work with sand particles in the water and should be reliable pumping clean mains water. The installer who suggested Caprari pumps informs me that submersible pumps can be left in-situ over the winter with the tank nearly full. This prevents freezing and no regular maintenance is required. Expected life, based on experience, is 25 years. Other installers generally advise that pumps, tanks and pipework need to be drained down in the winter. Detailed discussions with installation contractors are thus required to clarify the extent of the maintenance requirements!

Detailed pressure/flow calculations have been completed for all the pumps together with a variety of sprinkler types and piping configurations. The Caprari EXED40-12 is not only the cheapest but it readily meets all the pressure/flow requirements for a 21m radius and facilitates the use of cheaper sprinklers such as the Hunter i25 and Rainbird 8005. The combination of the Caprari pump and Rainbird 8005 provides a robust design that is cost effective.

The larger Caprari EXED40-17 (£730) submersible pump will just about meet the requirements for 4/6 sprinkler systems as will the expensive Grundfos SP9-11.

4. Sprinkler and Pipe Configurations

The original design document looked at the merits of 4, 6 and 8 sprinkler configurations. Even with the largest 2.2kW pumps a 4 sprinkler configuration of the kind employed on bowling greens remains problematic in terms of coverage. However, if two of the side sprinklers are replaced by four sprinklers then a 6 sprinkler option based around a 26m radius of throw is worth considering. The layout is shown in figure 1. Coverage is good except for a dry spot in the centre where the bench is located. I do not think this is important in terms of NDCC's irrigation objectives. Note that the lawn size shown is 64m x 52m compared with the actual size of 63m x 51m. This allows for a 0.5 m gap between sprinklers and the edge of the lawn.

The advantages of this 6 sprinkler option are that the large sprinklers with integrated valves are relatively easy to install and that the Ringmain piping allows both open trenching and mole trenching to be employed. With flow rates in excess of 8m^3 a Direct piping option (described below) is not feasible unless more expensive 63mm piping is used.

The constraint imposed by the nets (section 2, point e) and pump performance (section 3) mean that the original 8 sprinkler configuration is not feasible. The only option that is feasible is a modified version of the original 6 sprinkler option with the full two full circle sprinklers by four half circle sprinklers. This 8 sprinkler configuration requires sprinklers with a 21m operating radius rather than 18m in my original proposal.

The new 8 sprinkler configuration offers the possibility of two different piping layouts which are presented in figures 2 and 3. The piping options are:

5. A Ringmain option (figure 2) that offers the least pressure drop (of around 0.19 bar worst-case))
6. A Direct option that routes the main supply pipe down the centre of the lawns (figure 3). The worst-case pipe pressure loss is about 0.34 bar which is quite acceptable with appropriate choice of pump.

It can be seen from figures 2 & 3 that the Direct piping option requires pipework laying along most of the walkways between lawns. The Ringmain option (a) requires less disturbance of the walkways. The comparison distances are about 86m and 32m respectively. With mole trenching (as opposed to open trenching) this disturbance is fairly minimal. The big advantage of the Direct piping is that it requires only two thirds of the MDPE piping and the multicore cable needed to operate the valves. It also only needs 3 valve boxes compared with 6 for the Ringmain option. The

hardware savings are about £435 and labour saving of about 40% of the cost of trenching. Together, these are worth having if mole trenching is available as an option. However, not every installation contractor can offer mole trenching.

A useful bonus of this revised 8 sprinkler configuration is that effectively each lawn is covered by two sprinklers. This opens up the possibility of irrigating lawns individually. This might be useful during re-seeding operations.

5. Sprinkler Selection

5.1 Types of sprinkler

There are essentially three types of sprinklers available for consideration:

- a. Integrated units that contain both a valve and (three) nozzles. All are capable of what is known as Top servicing. The valves can either be operated using individual 24AC signals or networked signal from a 2-wire system. These units are capable of covering large areas up to about 28m radius but need high pressure and flow to achieve this. Typical cost is £250-350 per sprinkler. Typical examples include the Hunter TTS 800 series, Toro Flex 35/55 series and Rainbird 950 E.
- b. Units that are capable of Top servicing but need a separate flow control valve to operate. They can operate up to about 28m radius but again require high pressure and flow to achieve this. Typical cost is in the region of £140. Typical examples include the Hunter i80 and Hunter i90 series and the Toro Flex 35B series
- c. Units that need the soil around the top part to be removed for servicing. These operate at lower pressures and flows and can provide up to 22m radius of coverage. Typical cost is in the £55 to £90 range. Typical examples include the Hunter i25 and i40 series and Rainbird 6504 and 8005 series.

All the units lie slightly below ground level and pop up when activated. The pop-up action raises the nozzles by 10-15 centimetres and water flows out at angle of about 25 degrees. The nozzles rotate around through either a part or full circle. The arc is fully controllable. The colloquial name for such sprinklers is “rotors” because they rotate in an arc.

The Top serviced sprinklers can be fully maintained from the top without resorting to digging up the unit. The units that do not support Top servicing require about 2 inches of soil to be removed in order for the collar to be unscrewed and the mechanism removed from the outer covering. This is inconvenient but normally the upper sprinkler is surrounded by a 4 or 5 inch tube filled with gravel or sandy soil that can readily be removed for access. For NDCC this solution seems quite straightforward and obviates the need for Top servicing as a pre-requisite of sprinkler selection. The “a” and “b” sprinklers have 3 nozzles operating at different radii in order to provide even coverage. Some “c” sprinklers have 3 nozzles and others only 1. With smaller radii a single nozzle gives reasonably even coverage but at 21m a 3 nozzle set up is preferred.

The total cost of a sprinkler without an integrated valve includes the following:

- The sprinkler unit
- The swing joint required to connect the sprinkler to the pipe and support it in the correct position
- The valve cost if not integral with the sprinkler
- The valve box that provides suitable mounting space for the valve. More than one valve can be mounted in a single box if the pipework configuration allows it.

All sprinklers need a swing joint (cost £25-£35) but the valve (£52-£67) and valve box (£35) increase the total cost of a sprinkler without an integrated valve.

Generally, despite the cost of a valve and valve box, the separate valve plus sprinkler hardware is cheaper than the integrated valve sprinklers but involves more time to install. One large installer estimated that the installation of a valve and valve box adds 3-4 hours work per sprinkler. This could perhaps add £100 or more to the total cost per sprinkler.

One minor disadvantage of sprinklers with integrated valves is that the multi-core control cable joints have to be buried in the ground. Special waterproof splicing joints are utilised but the environment may lead to longer term joint corrosion and connection continuity problems. Golf club experience suggests this may not be significant problem. With a valve in a valve box the spliced cable joints are contained within the box and shielded from direct exposure to rainwater.

5.2 Selection for the 6 Sprinkler option

The 6 sprinkler option is only feasible if the sprinklers can deliver 26m radius of throw. To achieve this requires a pump that can deliver around 6-7 bar and $9\text{m}^3/\text{hr}$ flow rate. Inspection of figure 10 shows that only the Caprari E4XED40-17 and Grundfos SP9-11 can achieve this performance. Analysis of sprinklers performance was therefore concentrated on using the Caprari pump as it is half the price with arguably better performance.

With the high flow rates involved and nature of the sprinklers layout only a Ringmain piping arrangement is feasible with 50mm piping. (Changing to 63mm pipe would reduce the pressure drop but increase the pipe cost significantly)

Even with the Caprari pump it is a struggle to find sprinklers that can achieve a 26m radius of throw. Figure 5 shows the pressure/flow relationships for the pump and various integrated nozzle sprinklers (category "a"). The operating point is formed by the point intersection of the sprinkler curves with the curve representing pressure at the sprinkler (the green line). In all cases a 1.5 inch swing joint is assumed. The Rainbird, Hunter and Tor sprinklers can all be supplied by the pump. However, examination of figure 6 shows that only the Rainbird 950 with a #24 nozzle can satisfy the requirement for a 26m radius of throw. It operates at 5.7bar which corresponds to 26m radius. All the other sprinkler/nozzle combinations fall short by at 1 to 1.5 m. In general, with a 2.2kW motor achieving a 26m radius is difficult. The Caprari pump offers the best flow/pressure combination but one has to be very selective with the choice of sprinkler and nozzle. The class "b" sprinklers suffer additional pressure loss due to the control valve and are not an option for the 6 sprinkler configuration.

5.3 Selection for the 8 Sprinkler option

For the 8 sprinkler option analysis of a number of different sprinkler/pump combinations was carried out. Figures 6 & 7 contain results for the Hunter i25 and Rainbird 8005 with the Toro Flex 35-6B added for completeness. The first two are class "c" sprinklers whilst the Toro Flex 35-6B is the most suitable of the "b" class sprinklers.

Figure 6 shows the pressure/flow characteristics of the Pump in blue. There are two red and green dotted lines showing the worst-case pressure at the pump depending on whether 1.0 inch or 1.5 inch valves and swing joints are employed. The intersection of the sprinkler characteristics with these dotted lines represent the operating point for the combination. The operating pressure can be read off and used to establish the radius achieved using figure 7.

Regardless of whether 1 inch or 1.5 inch valves and swing joints are employed it is clear that the i25, although cheap at £55, struggles to achieve more than about 4.8 bar pressure and a radius of

20.3m. Selecting other i25 nozzles does not improve the situation. The more expensive Toro 35-6B sprinkler just reaches the desired 21 m radius but requires significantly more pressure to exceed a 21m radius. The £90 Rainbird 8005 comfortably provides 21.5m radius and thus provides a robust 1.5m margin over the minimum 20m radius required. The Rainbird 8005 incorporates a 3 nozzle setup which should provide more even coverage over the area being irrigated compared with a single nozzle sprinklers such as the Hunter i25. It also supports independent control of the two sides of the arc which makes sprinkler set up easier as sprinkler alignment is less critical.

The Caprari pump and Rainbird nozzle provide a robust solution that is relatively inexpensive using 1 inch fittings. This combination is therefore used in the costing exercise. Note that if the modelling of the final design from an installation contractor suggests that pressure at the sprinkler is lower than anticipated then 1.5 inch fittings can be employed. As an alternative, the pump capacity could be increased. The Caparari E4XED40-17 offers significantly higher pressure (but not flow) by virtue of being rated at 2.2kW rather than 1.5kW. The cost of this upgrade is only £48. Relative performance of the two pumps is displayed in figure 10.

Figures 8 and 9 show the results the larger Caprari pump with some of the class “b “ nozzles as well as the Rainbird 8005 with a larger nozzle. All operate at between 5.5 and 6 bar and deliver between 22 and 24 m radius. The Rainbird 8005 probably needs some pressure reduction (via the ICV valve) to avoid wasting water but the Hunter and Toro sprinklers are operating well within the normal range.

6. Valves and Swing Joints

Some of the valves on the market are classified as being for residential purposes only and have relatively high pressure losses. In the commercial application ranges, Hunter ICV and Toro P220 valves are available with 1.0 and 1.5 inch fittings. The Rainbird PGA series valve exist but at the flows of interest they only offer a 1.0 inch valve that has a relatively high pressure loss of around 0.45 bar. Both The Hunter and Toro valves offer lower pressure losses. The Hunter ICV valves are cheaper at £52 and £67 for 1 and 1.5 inch valves respectively. The 1.5 inch Toro valves are not recommended for the likely flow rates at Nailsea. Thus, Hunter ICV valves have been included in the modelling and costing exercises.

Swing Joints are essential to connect the sprinklers by virtue of two or three rotating elbow joints. Like the valves, different manufacturers models offer different pressure losses. Hunter publish pressure loss data whilst Rainbird simply make a claim that their swing joints offer less pressure loss but without hard data. This may well be true but I was unable to verify the statement so Hunter swing joints were included in both the modelling and costing exercises.

The choice of 1.0 or 1.5 inch swing joints does make a difference to the resulting pressure loss. In the modelling exercise for 1.5 inch fittings it was assumed that a sprinkler with a 1.0 inch inlet can be mated up with a 1.5 inch swing joint using a BSP thread adaptor without significant pressure loss. (The Rainbird 8005 has a 1 inch inlet)

The sum of valve and swing joint pressure losses can equal or exceed the pipe pressure losses. Thus both 1.0 and 1.5 inch valves/swing joints are included in the modelling. Figure 3 illustrates the difference between the two fittings sizes. It also suggests that the Rainbird 8005 can readily provide a coverage radius of more than 21m with the 1.0 inch fittings and there is no need to employ 1.5 inch fittings. However, the latter are available if needed for any reason.

7. Tanks

7.1 Tank sizing

In my original proposal the tank was sized at 5000 litres (5 m^3). The 8 sprinkler irrigation system operates with a design flow rate of about $5 \text{ m}^3/\text{hour}$. To provide a 2mm coverage of the lawns requires 6 m^3 of water which requires a 72 min runtime. During this period the mains will supply about 1.9 m^3 of water, leaving about 0.9 m^3 of water in the tank at the end of the operation. This volume corresponds to about 0.3m depth in a 5000 litre tank. However, the pump inlet requires a minimum depth of water of 0.35 m and it will be above the tank floor. Thus, to provide sufficient depth for the pump to operate without cavitation a 6000 litre tank is needed. This would ensure that minimum tank depth at the end of a run is about 0.6 m, which would be above the pump inlet minimum depth.

If the operating flow rate is higher than 5.0 m^3 then there would need to be a pause between the operation of one valve and the next in order for total run time to equal or exceed an hour. This feature is a common part of controllers such as the Hunter X2 8 Station model.

The extra 1000 litres capacity increases the basic tank cost from about £800 to £850.

7.2 Tank fittings.

The tank will need to be fitted out with a one-way inlet valve, camlock hosepipe connector and float valve arrangement to cut off the water supply when the tank is full. It will also need a low water level sensor and possibly other sensors to protect the pump. Costing these is difficult as there is a very wide range of products available. My approximate budget for these items is:

One way valve and Camlock connector	£100
Float valve	£100
Float switch to detect low level	£50
Drain and Isolation valves	£100

The pump over pressure relief valve is included with the pump costs.

These costs are subject to a degree of uncertainty as there is little published information relating to fittings for irrigation tanks. Some industrial fittings are more expensive but these are probably over specified for the task in hand.

An additional requirement identified by one contractor was a air ventilation facility to prevent legionnaires disease. This is a Wessex Water requirement. I am unsure if Bristol Water regulations require it but it would be wise to make provision of ventilation. At present, I have no cost information on this facility.

8. Control and Protection equipment

8.1. Pump control panel

The inductive motor needs a specialised start/stop relay. However, pumps are normally supplied with separate waterproof panels. The panel also provide electrical isolation and interlock circuitry to protect the pump. A variety of protection strategies seem to be employed including:

- a. Low tank water level measurement (essential)
- b. Motor power factor measurements
- c. Motor winding temperatures
- d. Motor current limits
- e. Flow and pressure measurements

The details may be pump specific but generally the commercial panels cost between £200 and £300 and can be mounted on an external or internal wall. At NDCC mounting on the internal wall by the machine room door would seem to be a convenient location. The new power supply cable from the electrical contract would enter from the ceiling (loft area) and make the instillation contractors task straightforward. He would be responsible for drilling through the wall and routing the power and interlock signals to/from the tank instrumentation underground using suitable conduit. Minimum depth for mains power cable is 350mm which could present a minor problem in that the cable will cross the drain pipe route to the ditch. The conduit will need to be carefully routed either over or under this drain pipe.

Switching inductive loads such as the pump motor can generate RFI interference which can disturb the electronics in the programmable timer control box. RFI can penetrate brick walls and Hunter, for example, recommend mounting the timer control box at least 4.5m from the pump control panel. This does depend on the shielding provided in the boxes so it will need the installer to determine the location of the timer controls. Mounting on the outside wall above the bike rack would be convenient from a cabling and operation point of view. However, if necessary, it could be mounted on the wall in the Gents changing room as there are power sockets to hand. NDCC would then need to run a low voltage (24V AC) multicore cable from the Gents to the machine room. (This does not need an Approved person).

8.2 Programmable Timer controls.

To operate the pump whilst opening the valves sequentially one at a time requires a programmable timer control box. The control box also needs to be able to support other functions such as single valve + pump operation for testing purposes. They start at about £100 but we may need to employ a slightly more expensive controller if the sequencing activities we need are not available on the cheaper options. This is difficult to ascertain from the manuals – I have tried so I know! Installation contractor advice will be needed to finalise the choice of box.

9. Concrete Plinth contract

The concrete plinth needed to support the tank (weight 6 tonnes!) needs to be in place well before installation takes place. The best option is to employ a local groundworks contractor who carries out this sort of activity every day. I had a verbal quote from a local firm E&M Groundworks who suggested the cost would be around £1000 for a 2.5m x 2.5m plinth with 6 inch of concrete reinforced with rebar mesh. The quote included digging out and providing a hardcore base for the plinth. The ground beyond lawn 5 towards the ditch is not solid so good firm foundations and rebar are probably essential to support the tank weight.

The quote included £350 for 1.5-2.0 cubic metres of ready mixed concrete delivered on a MiniMix lorry. These weigh around 10 tonnes and should be able to get into the car park without destroying the track. E&M Groundworks would use powered wheelbarrows to deliver the mix to the correct spot on the boundary of lawn 5.

10. Electrical Contract.

Installing a new cable and RCD to the main pavilion board is not a difficult task. However, the connection must be made by an Approved person who is familiar with the latest IET Regulations (the 18th edition). My suspicion is that they will only connect the cable if the whole board is replaced with a new one that complies with current regulations. I know from personal experience that the cost of board replacement is around £500. With £250 extra to install and connect the additional power cable, the expected total cost is around £750.

This work can also be carried out ahead of the installation contract. More importantly, the power cable should be temporarily safely terminated near where the Pump control panel is to be installed in the machine room. This means that the Installation contractors merely has to screw the panel to the wall and connect the power cable to the appropriate terminations within the panel. This is a very straightforward task that minimises installation work and risk.

11. Installation Contract

The installation of irrigation systems is something of a specialist field and it has not yet been possible to identify a local installer. I have been in touch with a number of more distant installers including:

- | | |
|--------------------|--------------|
| a. MJ Abbott | Wiltshire |
| b. Oakridge Water | Langport |
| c. Smith & Jones | Exeter |
| d. Hortech systems | Lincolnshire |
| e. BuyIrrigation | Sheffield |

There are others that I have not yet been in contact with:

- | | |
|----------------------|--|
| f. Green Irrigation | Wiltshire
(recommended by KAR UK, large UK distributor) |
| g. LS Systems | Lancashire |
| h. City Irrigation | Kent |
| i. Access Irrigation | Northampton |

I am sure there are others but until a decision to proceed is made there is little point in pursuing them. Duncan Hector supplies kits for do-it-yourself clubs. These are no cheaper than the fully installed options developed in this document and the DIY option is not realistic for NDCC. If a decision is made to proceed with the scheme, I may approach local golf, football and rugby clubs to see which contractors they employ.

The job is really too small for MJ Abbott but they did offer to put us in touch with other smaller contractors who would be more appropriate. Smith & Jones were slightly reluctant to come as far as Nailsea. On the other hand, companies such as BuyIrrigation and Hortech seem quite happy to work across the country.

12. Cost estimates

The purpose of exploring the various design issues is to establish the feasibility of being able to procure a system that is both robust and affordable. Table 1 provides some updated cost estimates based around the 6 and 8 sprinkler options described in previous sections.

The equipment costs can mostly be obtained via advertised retail prices and include VAT. Installers will be able to procure equipment at lower costs but then add on their own margin so it is not possible to know exactly what the final charge would be.

The installation costs are extrapolated from those advertised for installing bowling green systems. Generally, installers suggest a weeks work for two people but caveat it with the costs associated with connecting to services. In NDCC's case the design eliminates all the plumbing costs and minimises the electrical component.

The bowling green systems are all based on large sprinklers with integrated valves. MJ Abbott (a major installer) tell me that each of these integrated sprinklers takes about 0.75 hours to install. By contrast, digging out a hole for a valve box and valve, fitting them and making good takes 4 to 5 hours. Thus, to estimate costs for options A and B which use valves I have added in extra time as follows

Option A	3 valve boxes	@ 4 hours extra per box (multiple valves per box)
Option B	6 valve boxes	@ 3 hours extra per box (mostly single valve per box)

This corresponds to between 1.5 and 2.0 man-days effort. The total manpower estimates included in the table are thus as follows:

Concrete Plinth	Included in quote of £1000
Electrical Contract	1 man-day + replacement board
Trenching/Mole Trenching	1 man-day + equipment hire
Making good after pipe laying	1 man-day
Equipment installation and commissioning	6 man-days
Option A	1.5 man-days for valves
Option B	2.0 man-days for valves

Option C has no extra time allowed because it is based around large sprinklers with integrated valves as used on bowling greens.

The basic installation time of 6 man-days was a verbal estimate from one installer last year (Hortech systems)

The installation manpower estimate is thus between 9 and 11 man-days depending which option is chosen. Given that the installer has no plumbing work to do and electrical connection work is very simple I would have thought the cost estimates are reasonable. The manpower rate is based on £250/day + £50/accommodation cost +VAT. Nobody has mentioned travel or delivery costs in my discussions with installers.

Options A and C look to be the most cost effective but all come out at around £10,000 including VAT. I had a verbal quote from BuyIrrigation in Sheffield of £8,500 to £10,000 (+VAT) based on a very brief description of the system. The bowling green system installers quote about £7500 +VAT for a 4 sprinkler system. Option C is basically the same but with two extra sprinklers and some extra MDPE piping+multicore cable. This is the type of arrangement most installers will propose because it is the simplest but requires expensive sprinklers. The cost estimate of £10,000, seems achievable but we will only know for certain if we invite tenders from installers.

TABLE 1. COST OF OPTIONS

ITEM	Option A - 8 Sprinklers with Direct Piping	Cost inc. VAT	Option B -8 Sprinklers with Ringmain piping	Cost inc. VAT	Option C - 6 Sprinklers with Ringmain and integrated valve spinklers	Cost inc. VAT
Pump	Caprari 4XED-40-12 Submersible Pump	682.8	Caprari 4XED-40-12 Submersible Pump	682.8	Caprari 4XED-40-12 Submersible Pump	730.8
	Brass Pressure Relief Valve and T section	40	Brass Pressure Relief Valve and T section	40	Brass Pressure Relief Valve and T section	40
Tank + fittings	6000 Litre Tank	850	6000 Litre Tank	850	6000 Litre Tank	850
	To include One way and filling valve with camlock connector, drain and isolation valve, level float switch and ventilation for legionaires disease	350	To include One way and filling valve with camlock connector, drain and isolation valve, level float switch and ventilation for legionaires disease	350	To include One way and filling valve with camlock connector, drain and isolation valve, level float switch and ventilation for legionaires disease	350
Sprinklers	8 x Rainbird 8005 with Stainless Steel risers and #20 nozzles	720	8 x Rainbird 8005 with Stainless Steel risers and #20 nozzles	720	6 x Rainbird 950 and #24 nozzles	1938
Sprinkler Swing Joints	8 off 1.0 inch fittings	240	8 off 1.0 inch fittings	240	6 off 1.5 inch fittings	210
Solenoid Valve	8 off Hunter ICV 1" Globe valves	416	8 off Hunter ICV 1" Globe valves	416		
Valve Box	3 off	105	6 off	210		
Cable	Approx 125 m of 5 core 24 AC Cable to Solenoids (Farnell 21AWG , 0.5 mm^2)	81.25	Approx 325m of 5 core 24 AC Cable to Solenoids (Farnell 21AWG , 0.5 mm^2)	211.25	Approx 200m of 7 core 24 V AC Cable (Farnell)	170
Sequence Controller/Timer	Hunter X2 8 station controller	130	Hunter X2 8 station controller	130	Hunter X2 8 station controller	130
Pump Control Panel	Control Panel with Pump Start Relay and interlocks	250	Control Panel with Pump Start Relay and interlocks	250	Control Panel with Pump Start Relay and interlocks	250
Pipe	Approx 180 m of MDPE 50mm Pipe (Pipestock price)	424.80	Approx 325m of MDPE 50mm pipe (Pipestock price)	767	Approx 220 m of MDPE 50mm Pipe (Pipestock price)	519.20
Pipe T sections, Elbows and Tooling	Estimate	100	Estimate	100	Estimate	100
	Sub Total	4389.85	Sub Total	4967.05	Sub Total	5288
Concrete Base	Concrete Base for Tank	1000	Concrete Base for Tank	1000	Concrete Base for Tank	1000
Electrical Contract	Electrical work in Pavilion for 30A supply to Pump (assumes new circuit board to conform to IET Regs)	750	Electrical work in Pavilion for 30A supply to Pump (assumes new circuit board to conform to IET Regs)	750	Electrical work in Pavilion for 30A supply to Pump (assumes new circuit board to conform to IET Regs)	750
Trenching or Mole Trenching	Trenching	550	Trenching	550	Trenching	550
	Making good after pipe laying	250	Making good after pipe laying	250	Making good after pipe laying	250
Installation manpwer	Equipment Installation (3 days for 2 men at £300/man-day+VAT)	2160	Equipment Installation (3 days for 2 men at £300/man-day+VAT)	2160	Equipment Installation (3 days for 2 men at £300/man-day+VAT)	2160
	Extra 1.5 days labour for valve/valve box installation	540	Extra 2.25 days labour for valve/valvebox installation	810		0
	Sub Total	5250	Sub Total	5520	Sub Total	4710
	OVERALL TOTAL	9640	OVERALL TOTAL	10487	OVERALL TOTAL	9998

Figure 1. Ringmain piping using integrated -valve sprinklers for 6 Sprinklers

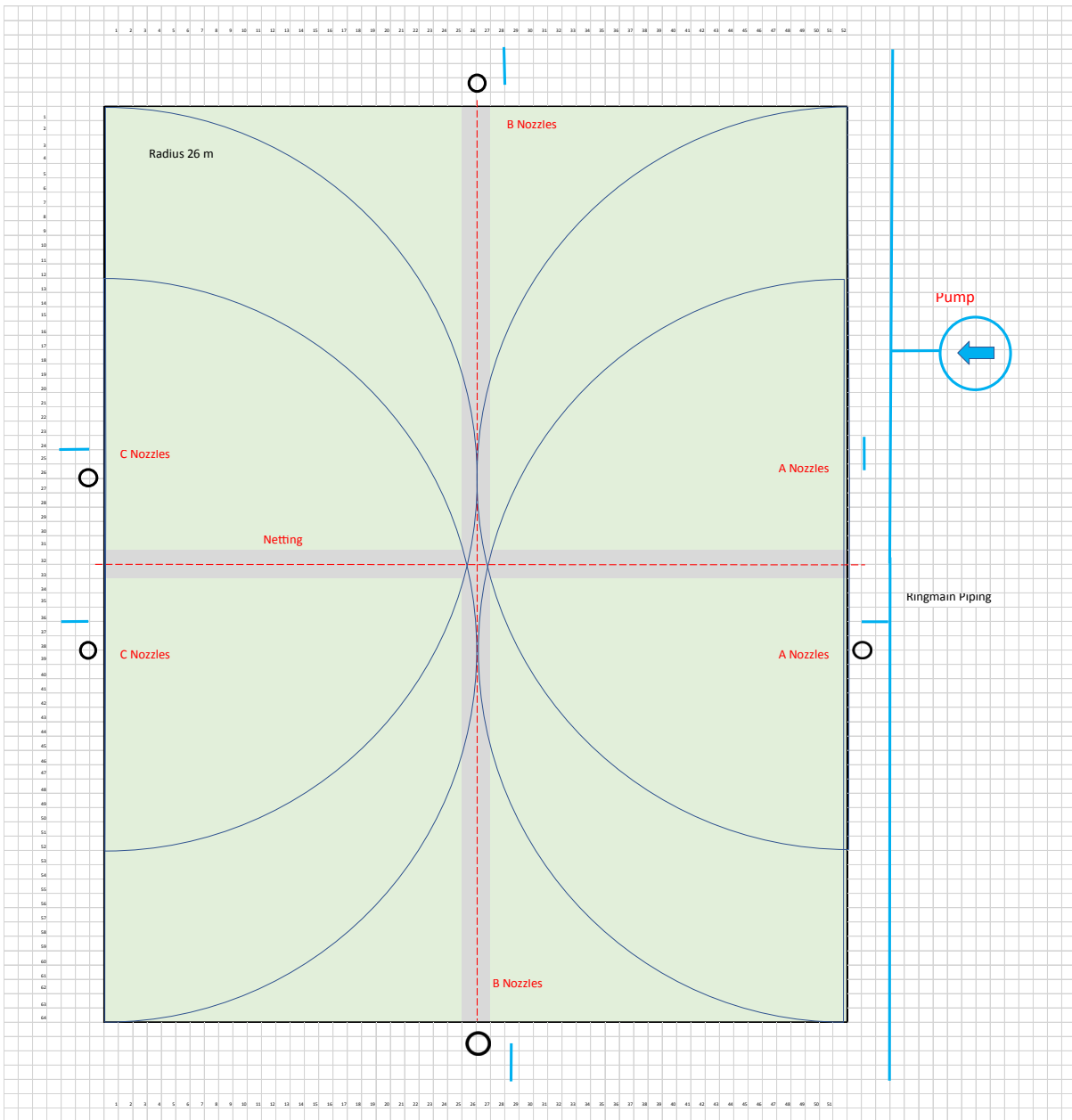


Figure 2. Ringmain piping for 8 Sprinklers

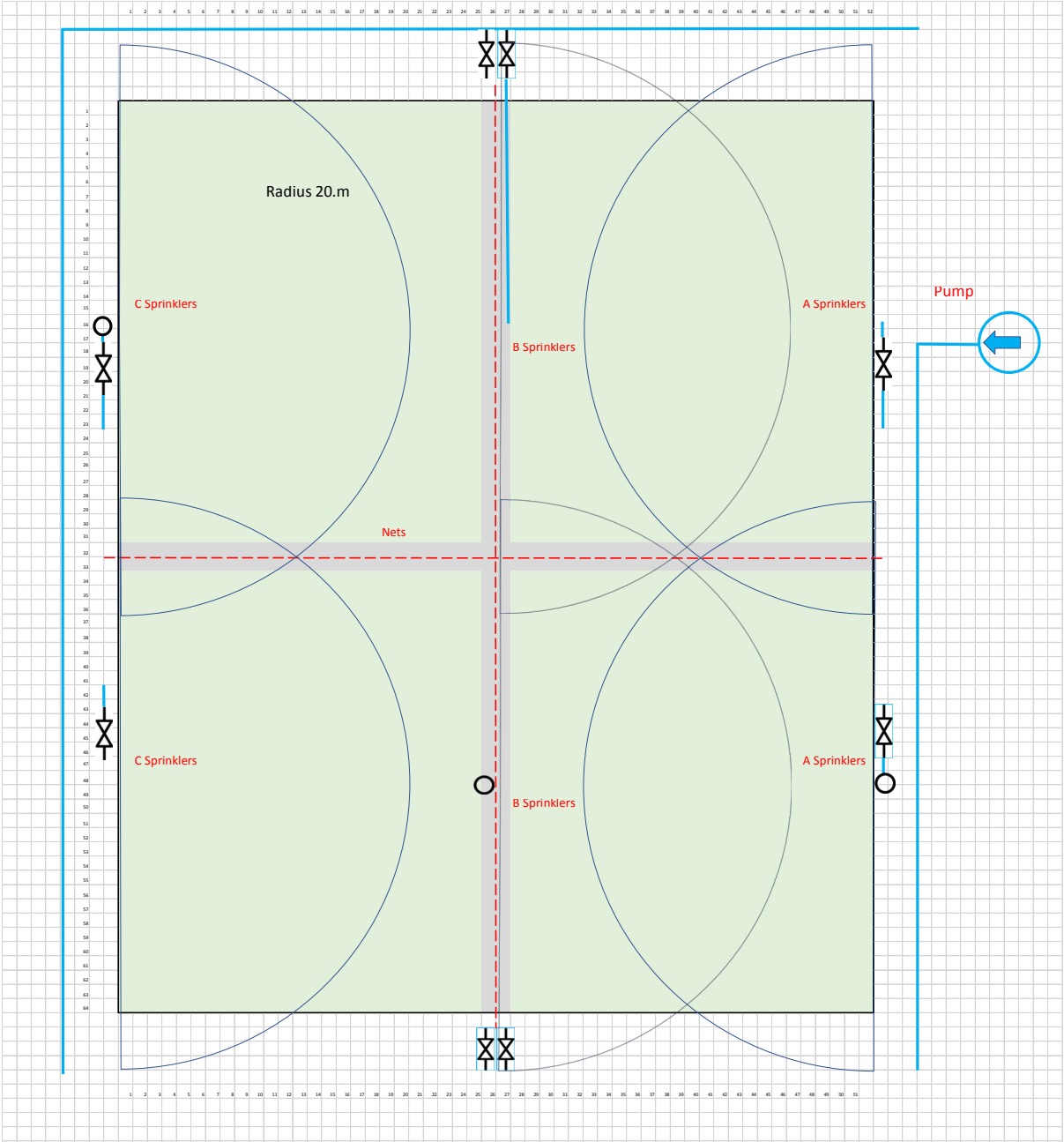


Figure 3. Direct piping arrangement for 8 Sprinklers

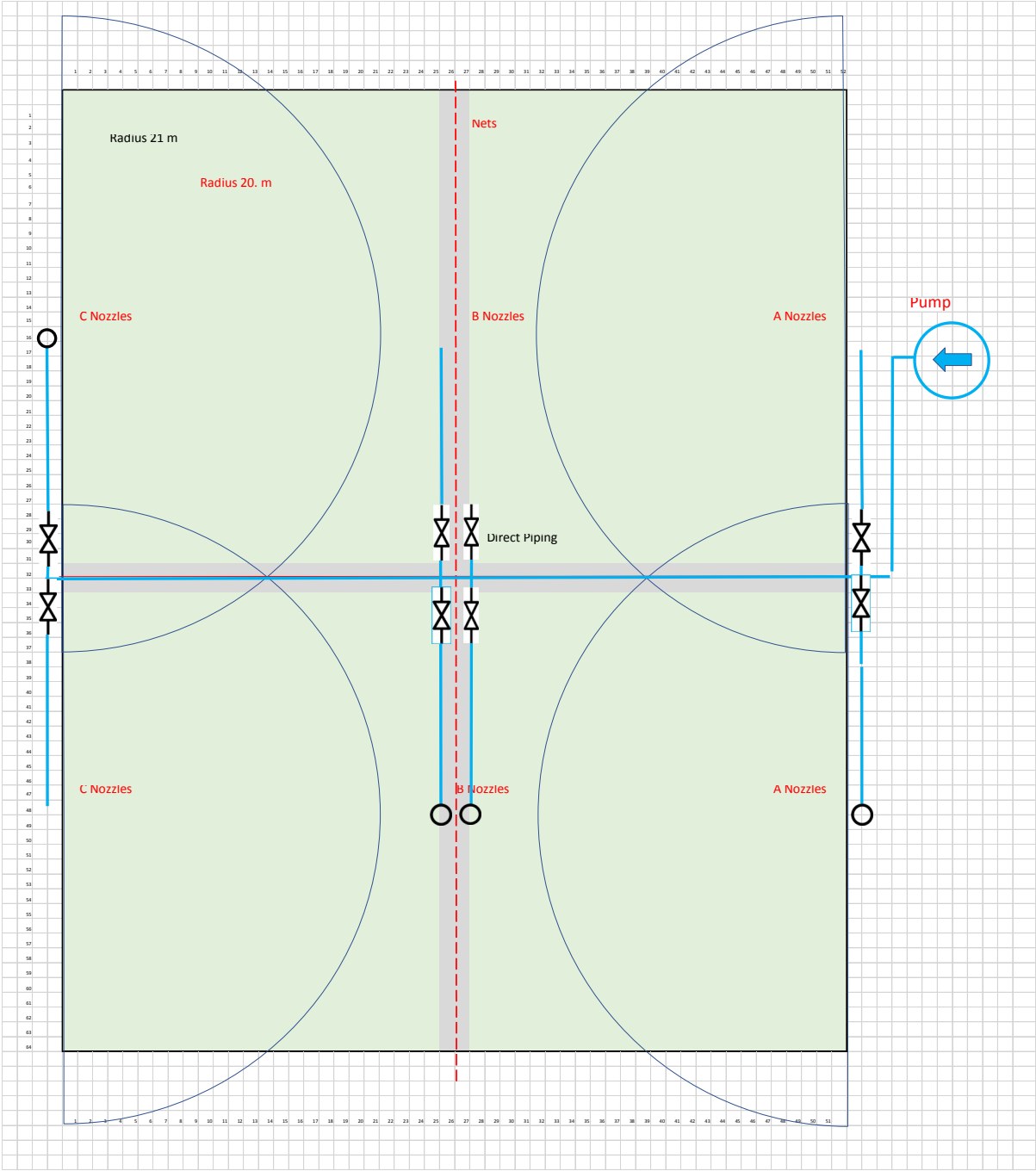


Figure 4. Pressure/flow relationships for 6 Sprinklers with Ringmain piping.

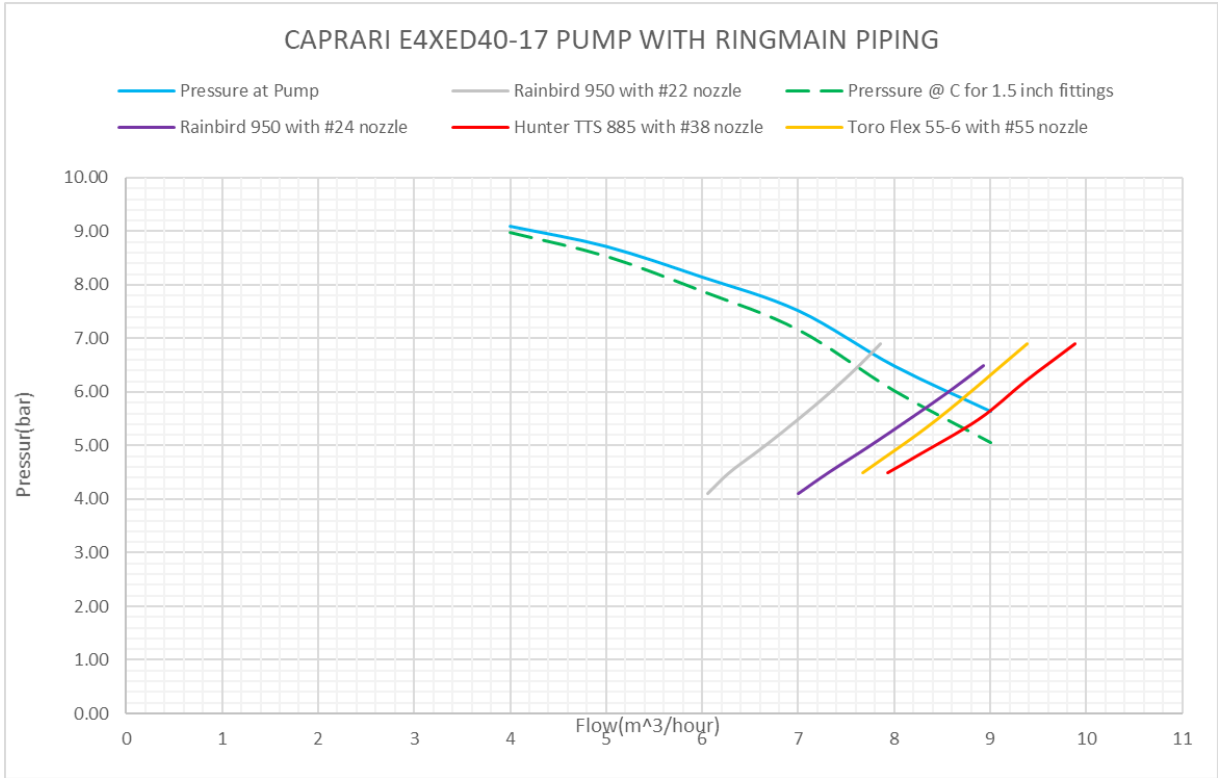


Figure 5 Radius/pressure relationship of 6 Sprinklers with Ringmain piping

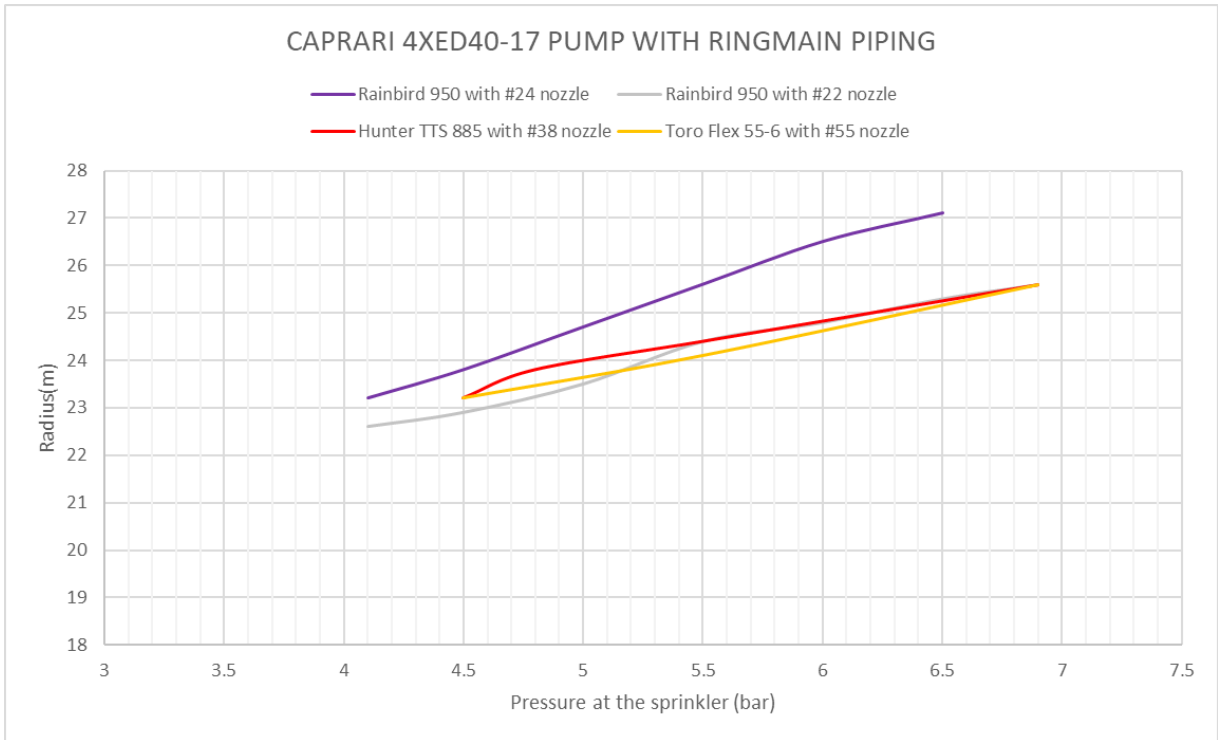


Figure 6. Pressure/flow relationships for 8 sprinklers with Direct piping

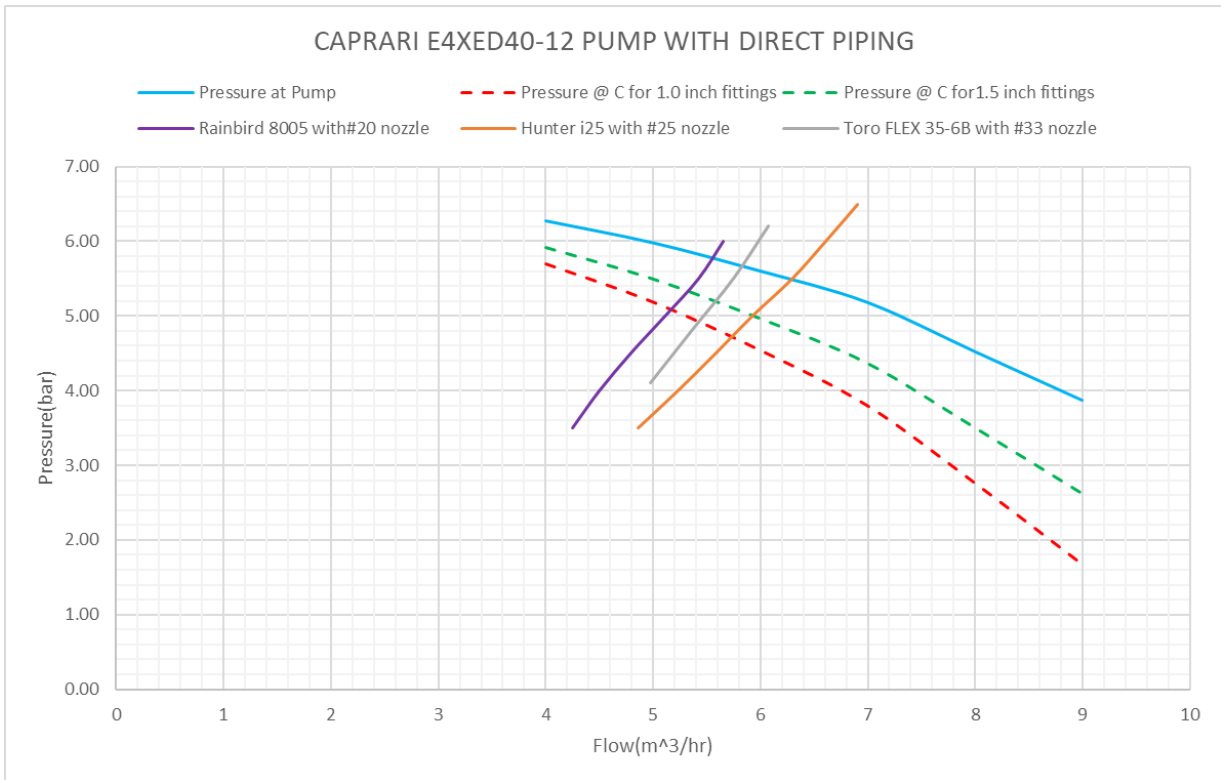


Figure 7. Radius/pressure relationship for 8 Sprinklers with Direct piping.

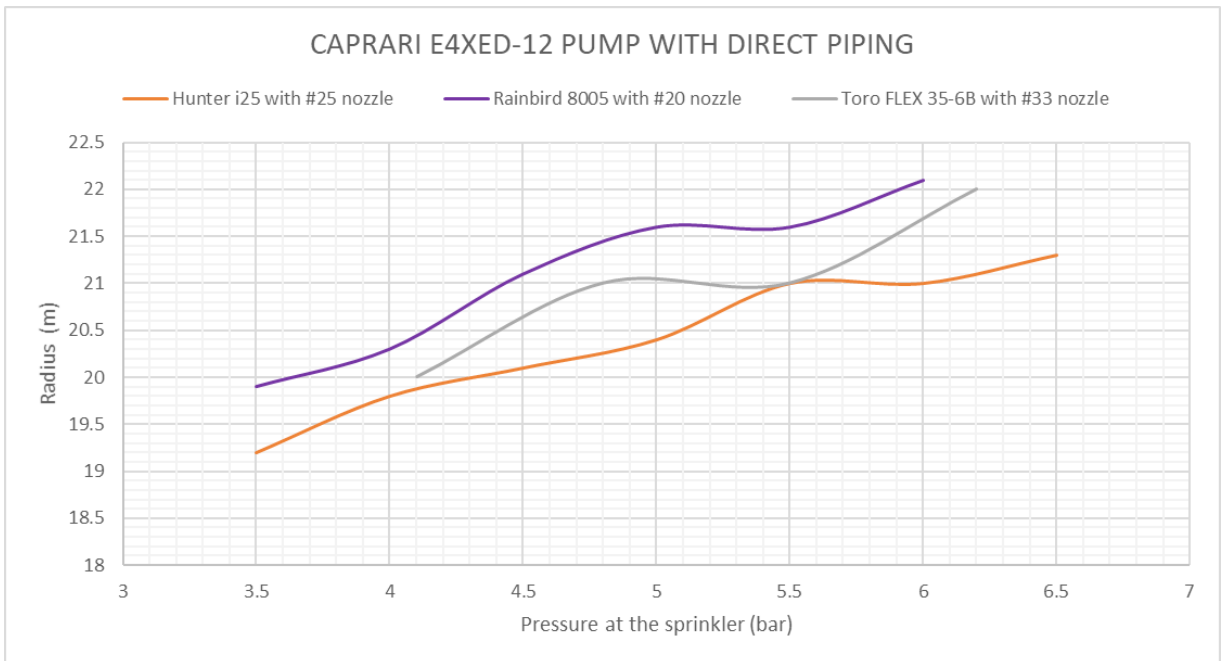


Figure 8 Pressure/flow relationships for 8 sprinkler system with larger pump and class “b” sprinklers.

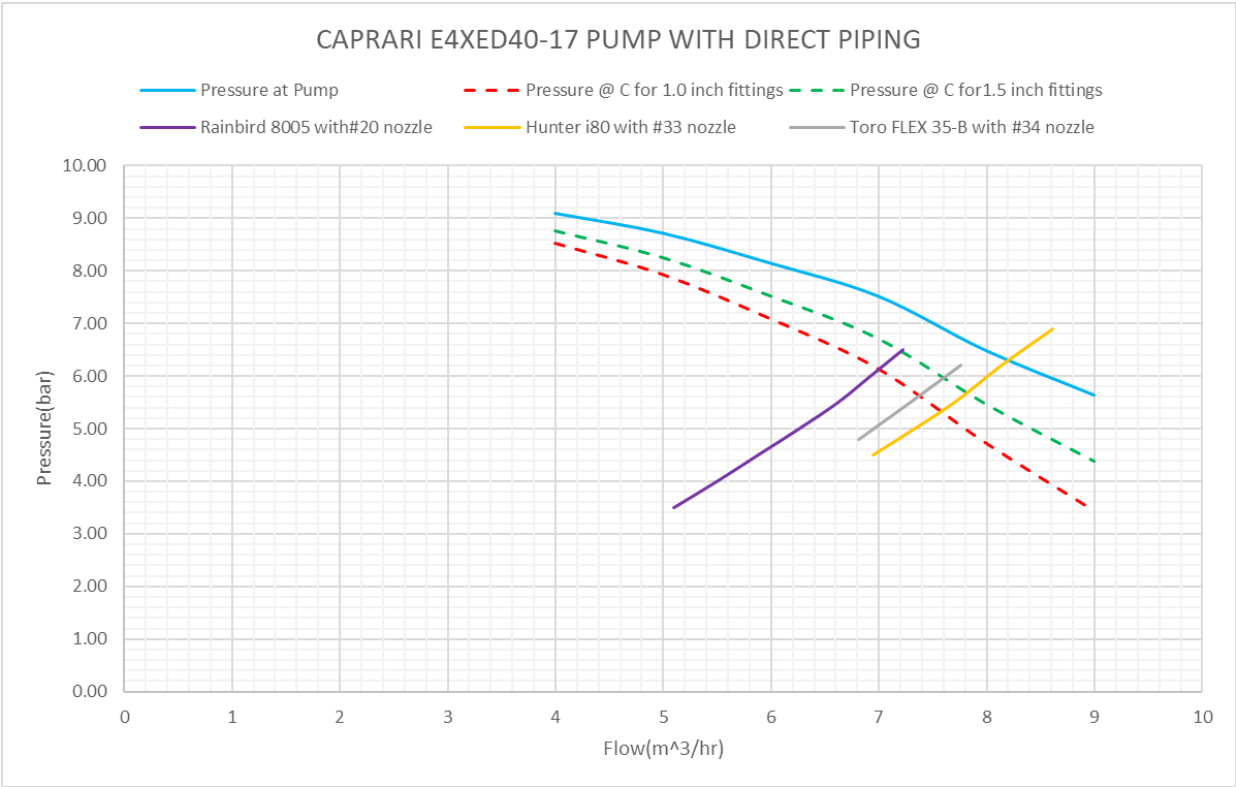


Figure 9 Radius/Pressure relationship for 8 sprinkler system with larger pump and class “b” sprinklers.

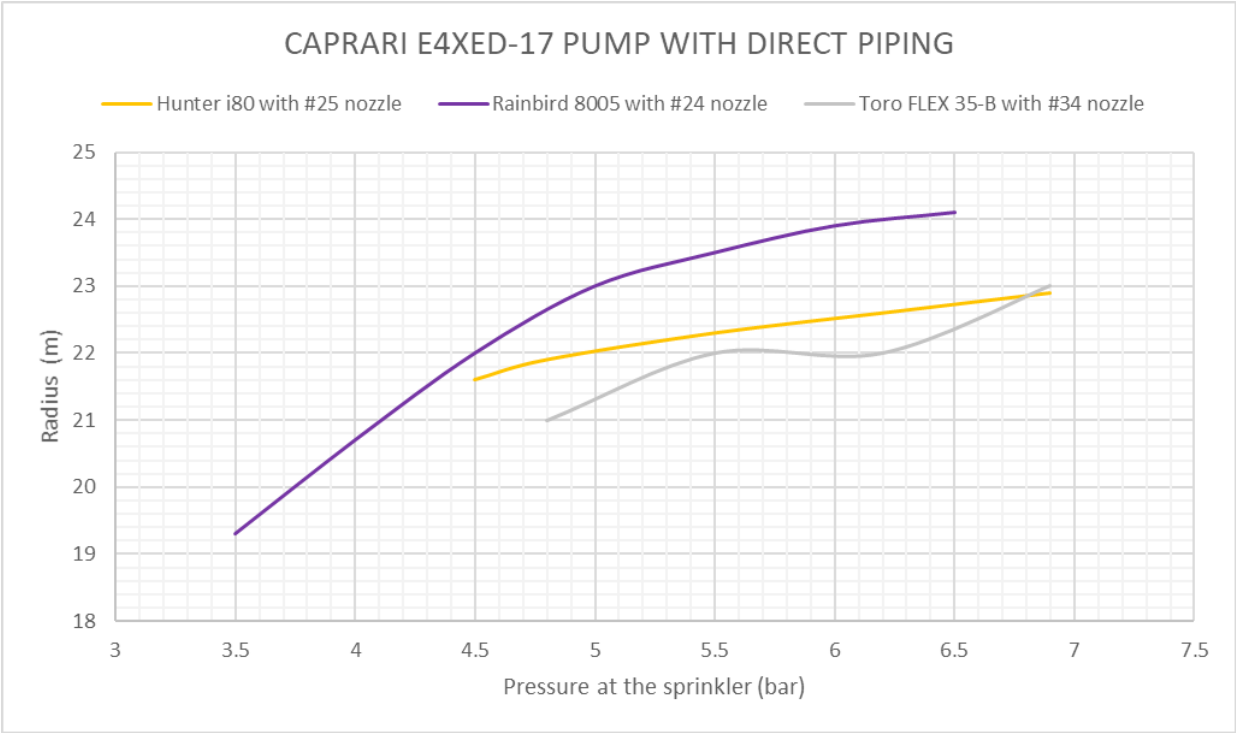


Figure 10 Pump Characteristics

Pump Characteristics

