

Appendices

(To be read in conjunction with the main document)

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2. Schedule of areas
3. Further layouts of 'Affordable' Sports Centres with Community 25 m Pool Options
 - **Option A:** 4-lane swimming pool + 4-court sports hall + 50-station health and fitness gym + studio
 - **Option B:** 6-lane swimming pool + 4-court sports hall + 100-station health and fitness gym + 2 studios
 - **Option C:** 6-lane swimming pool and secondary pool + 4-court swimming pool + 100-station health and fitness gym + 2 studios
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Affordable Sports Centres with Community 25 m Pool Options

Appendix 1: Detailed accommodation list

The additional information in this Appendix should be considered in conjunction with the main Affordable Sports Centre document and previous documents *Affordable Community Swimming Pools* and *Affordable Sports Halls*. The designs and specifications are applicable to many locations with widespread benefits but should be reviewed in the context of a particular project. It should be noted, for example, that the plan options are based on a fixed floor profile in the swimming pools and the adoption of moving floor technology will have an influence on the user capacity and changing accommodation. Similarly, variations in seating numbers and the energy targets that are set for the building will have an impact on the overall area of the building.

The 'indicative' plans and specifications will require detailed considerations in the context of the particular project.

Options for 'Affordable' sports centres:

- Option A** 4 lane swimming pool + 4 court sports hall + 50 station health and fitness gym + studio
- Option B** 6 lane swimming pool + 4 court sports hall + 100 station health and fitness gym + 2 studios
- Option C** 6 lane swimming pool and secondary pool + 4 court sports hall + 100 station health and fitness gym + 2 studios
- Option D** 8 lane swimming pool and secondary pool + 5 court sports hall + 100 station health and fitness gym + 2 studios

Summary facility mix for the 4 options				
Options	A	B	C	D
Sports hall	4 court	4 court	4 court	5 court
Equipment storage	86 m ²	86 m ²	86 m ²	108 m ²
Dry changing	2 x 30p	2 x 30p	2 x 30p	2 x 30p
Swimming pool / Secondary pool (SP)	4 lane	6 lane	6 lane + SP	8 lane + SP
Wet changing	24p + 4 x F/D	36p + 4 x F/D	48p + 4 x F/D	62p + 4 x F/D
Buffer / school / group changing	2 x 20p	2 x 20p	2 x 20p	2 x 20p
Changing places/ full accessible provision	CPF + DWC + AC	CPF + DWC + AC	CPF + DWC + AC	CPF + DWC + AC
Health + fitness	Small	Medium	Medium	Medium
Gym	50p	100p	100p	100p
Studio(s)	20p	2 x 25p	2 x 25p	2 x 25p
Dedicated Changing / full Accessible provision	2 x 13p + DWC + AC	2 x 25p + DWC + AC	2 x 25p + DWC + AC	2 x 25p + DWC + AC
Notes: p = people st = gym stations AC = Accessible changing CPF = Changing places facility DWC = Disabled toilet F/D = Family (4p) / disabled changing cubicle Gym numbers calculated at 4.5 m ² / person Studio numbers calculated at 5 m ² / person				

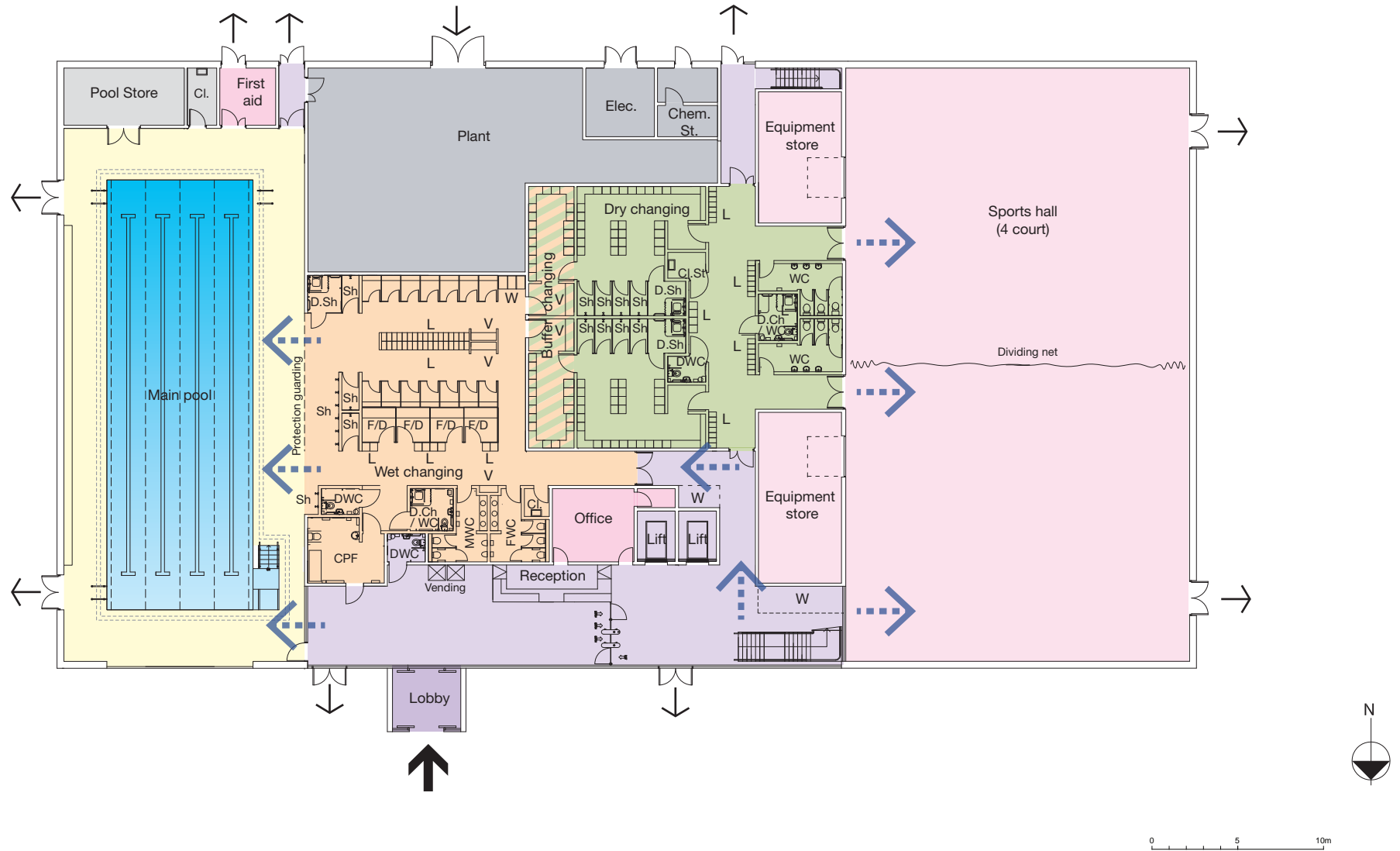
Appendix 2: Schedule of Areas (m²)

	Option A	Option B	Option C	Option D
Space / description	<ul style="list-style-type: none"> 4-court sports hall Small health and fitness suite 4-lane swimming pool 	<ul style="list-style-type: none"> 4-court sports hall Medium health and fitness suite 6-lane swimming pool 	<ul style="list-style-type: none"> 4-court sports hall Medium health and fitness suite 6-lane swimming pool, plus learner pool 	<ul style="list-style-type: none"> 5-court sports hall Medium health and fitness suite 8-lane swimming pool, plus learner pool with spectator seating
Reception / foyer areas (including entrance and first floor foyer)	223	232	260	244
Lift core areas	14	14	14	14
Core	19	39	36	41
Front of house disabled WC	4	4	3	3
Corridors and fire lobbies	168	176	224	234
Overall wet changing areas	232	312	370	415
Pool hall	434	558	731	912
Pool store	23	35	45	54
First aid room	11	11	9	9
Dedicated poolside cleaner's store	6	6	5	3
Buffer changing areas	43	43	43	43
Sports hall male changing	49	49	50	50
Sports hall female changing	49	49	50	50
Dry side female WC	11	11	11	11
Dry side male WC	12	12	11	11
Dry side accessible WC	3	3	4	3
Dry side accessible changing room	6	6	6	6
Dry side cleaner's store	3	3	3	6
Sports hall	690	690	690	876
Sports hall store	85	87	86	107
Offices / staff accommodation total (including IT rooms)	67	81	63	80
H&F male changing (incl. WCs)	33	51	51	53
H&F female changing (inc. WCs)	33	51	52	53
H&F accessible changing / WC	10	10	10	10
H&F cleaner's store	2	3	3	2
Gym	225	448	450	446
Gym store	13	19	19	17
Studio 1	100	125	125	123
Studio 1 store	13	17	17	16
Studio 2		125	125	123
Studio 2 store		17	17	16
Pool spectator seating				97
Internal plant area allocation	226	179	222	259
Total internal floor areas	2,807	3,464	3,798	4,378
Total gross internal areas (GIFA)	2,879	3,553	3,906	4,509
Footprint	2,361	2,555	2,909	3,274

Appendix 3: Further layouts of 'Affordable Sports Centres with 25 m Pool Options

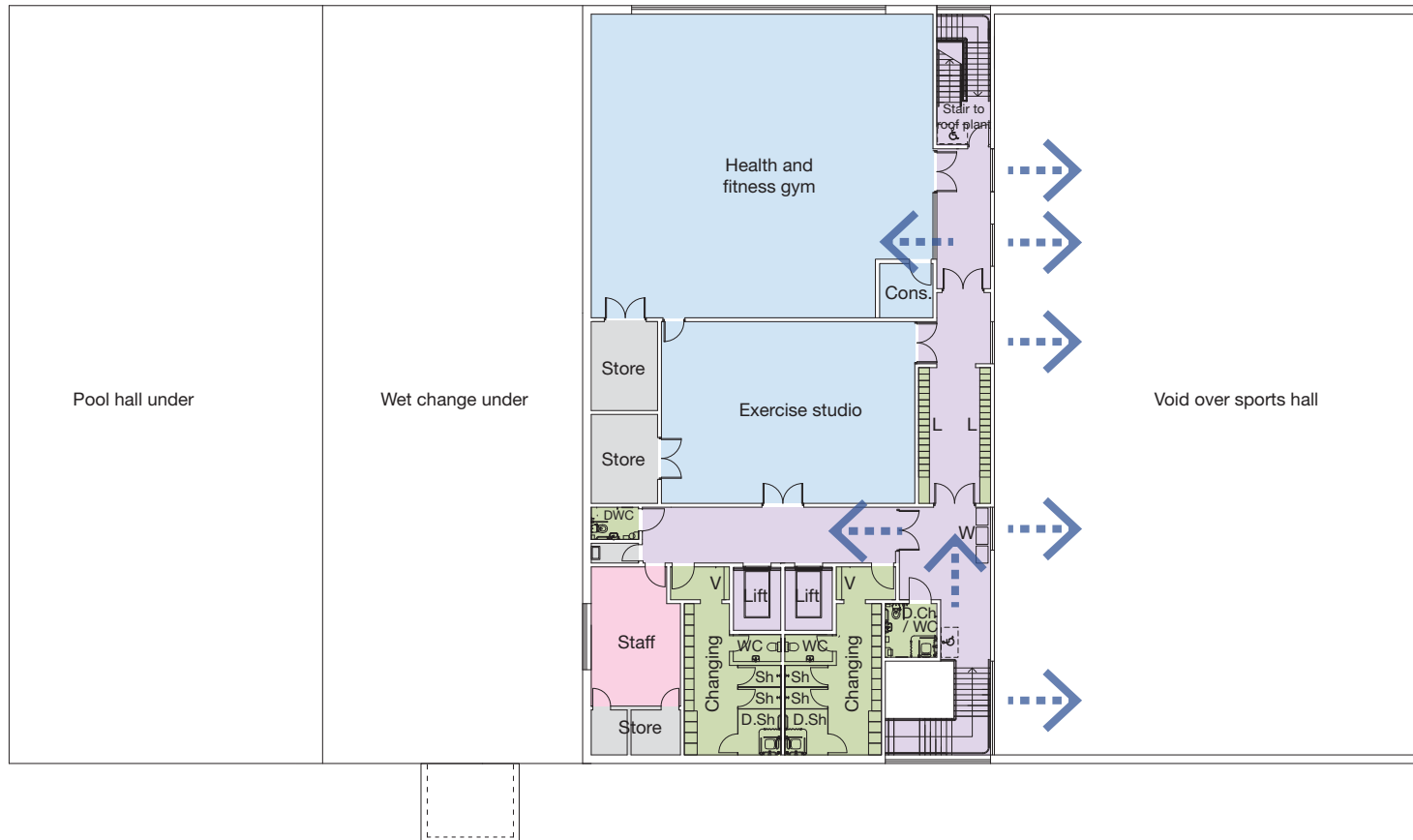
Option A 4 lane swimming pool + 4 court sports hall + 50 station health and fitness gym + studio

Ground floor



Option A 4 lane swimming pool + 4 court sports hall + 50 station health and fitness gym + studio

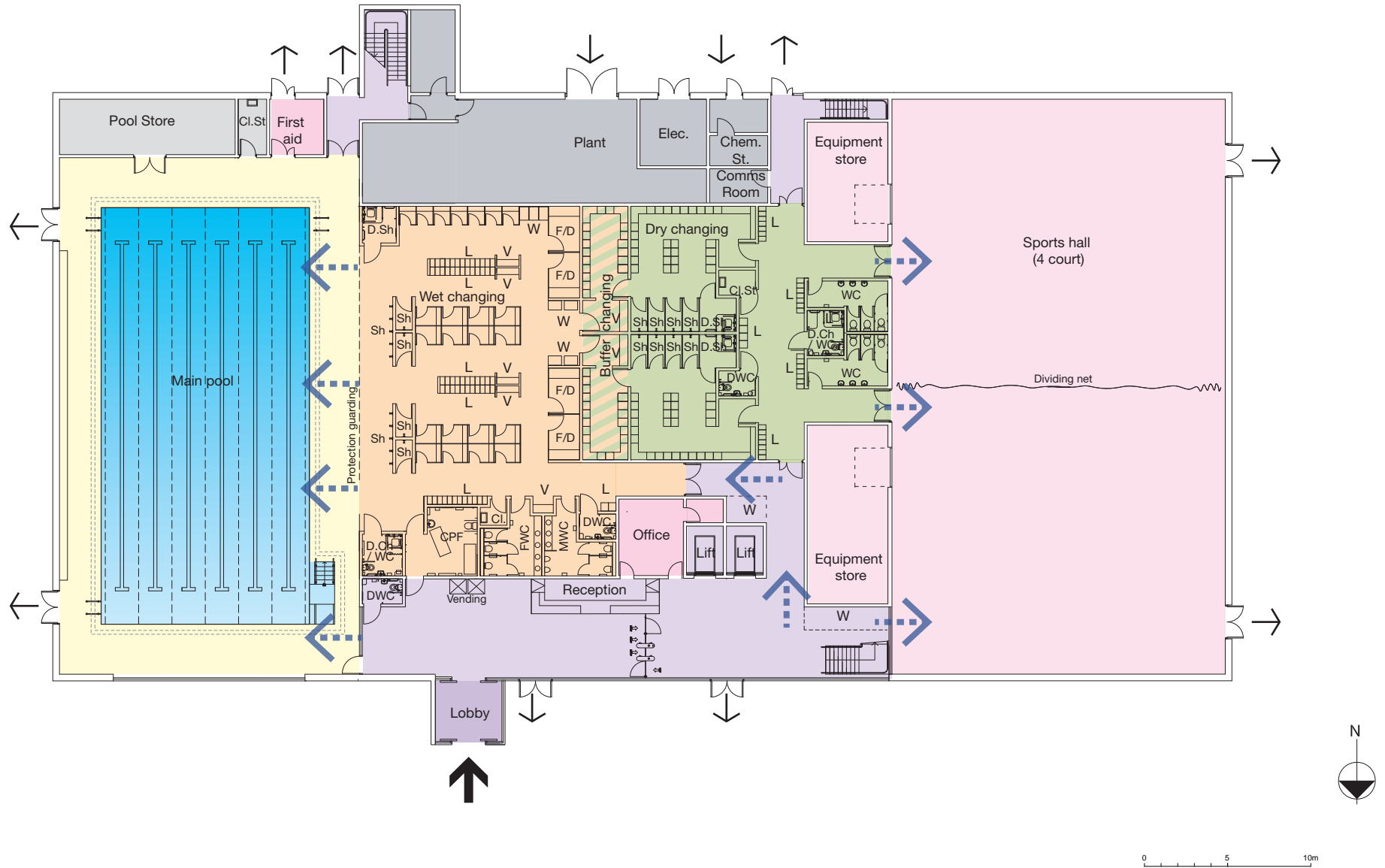
First floor



0 5 10m

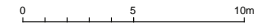
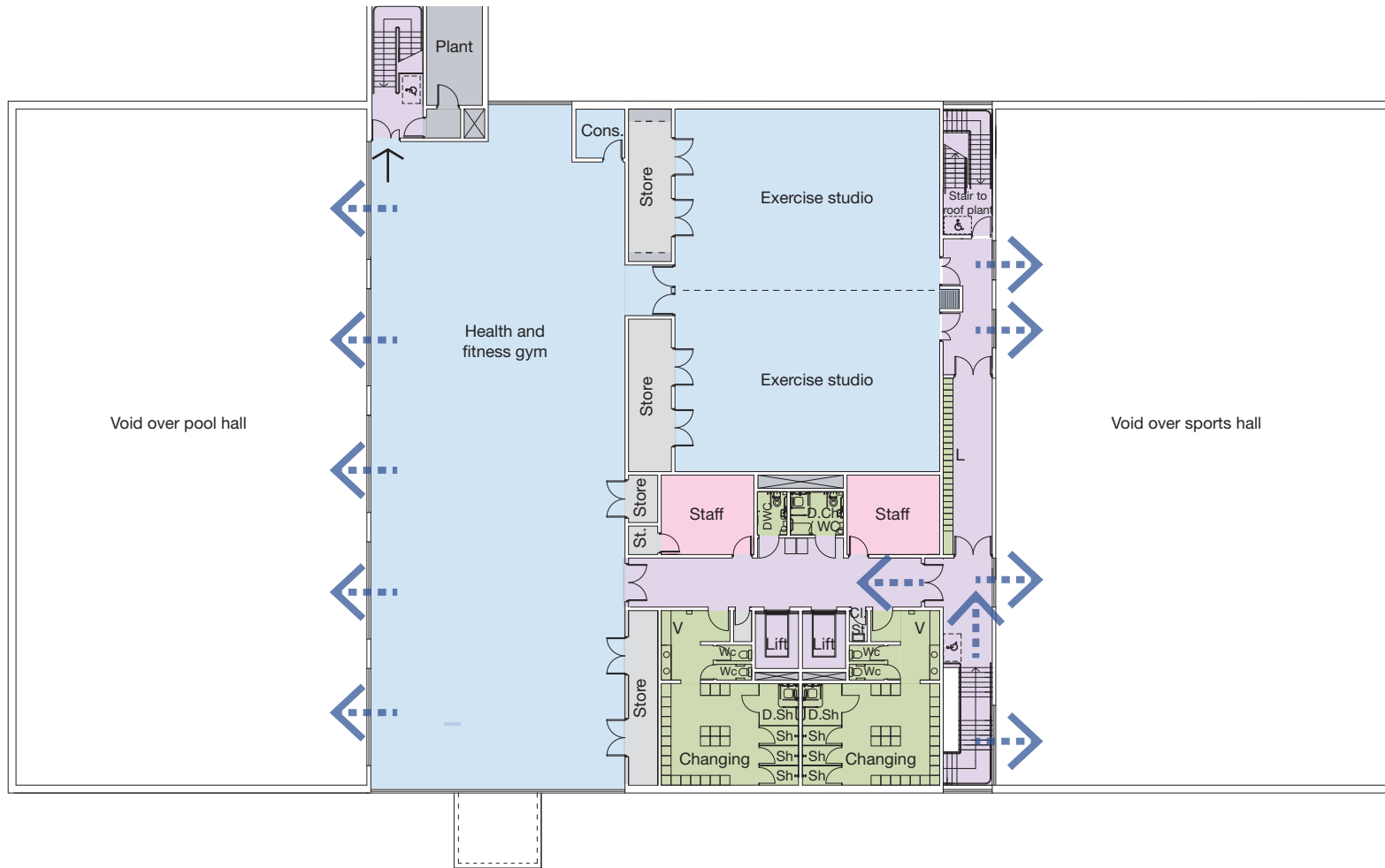
Option B 6 lane swimming pool + 4 court sports hall + 100 station health and fitness gym + 2 studios

Ground floor



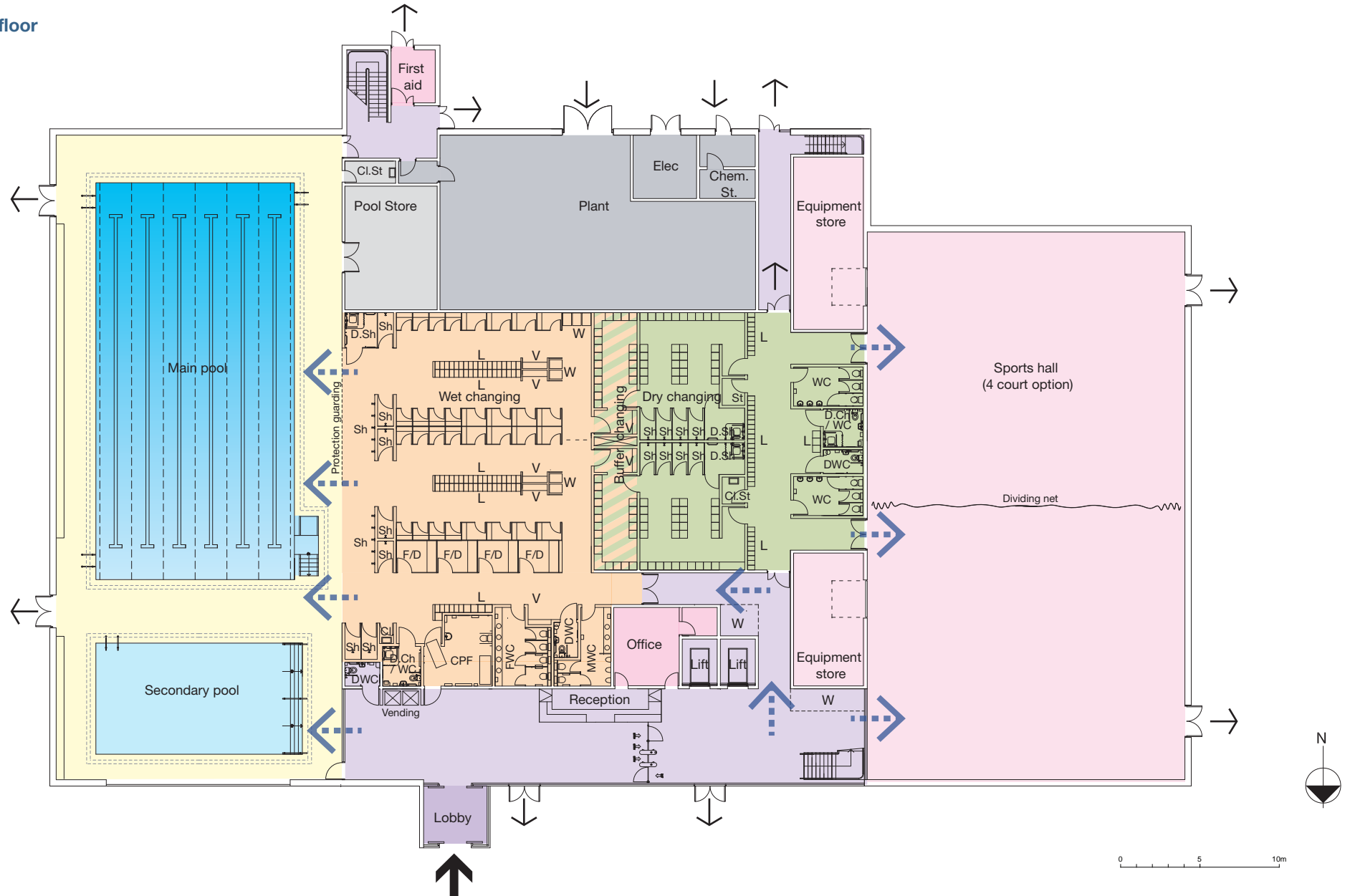
Option B 6 lane swimming pool + 4 court sports hall + 100 station health and fitness gym + 2 studios

First floor



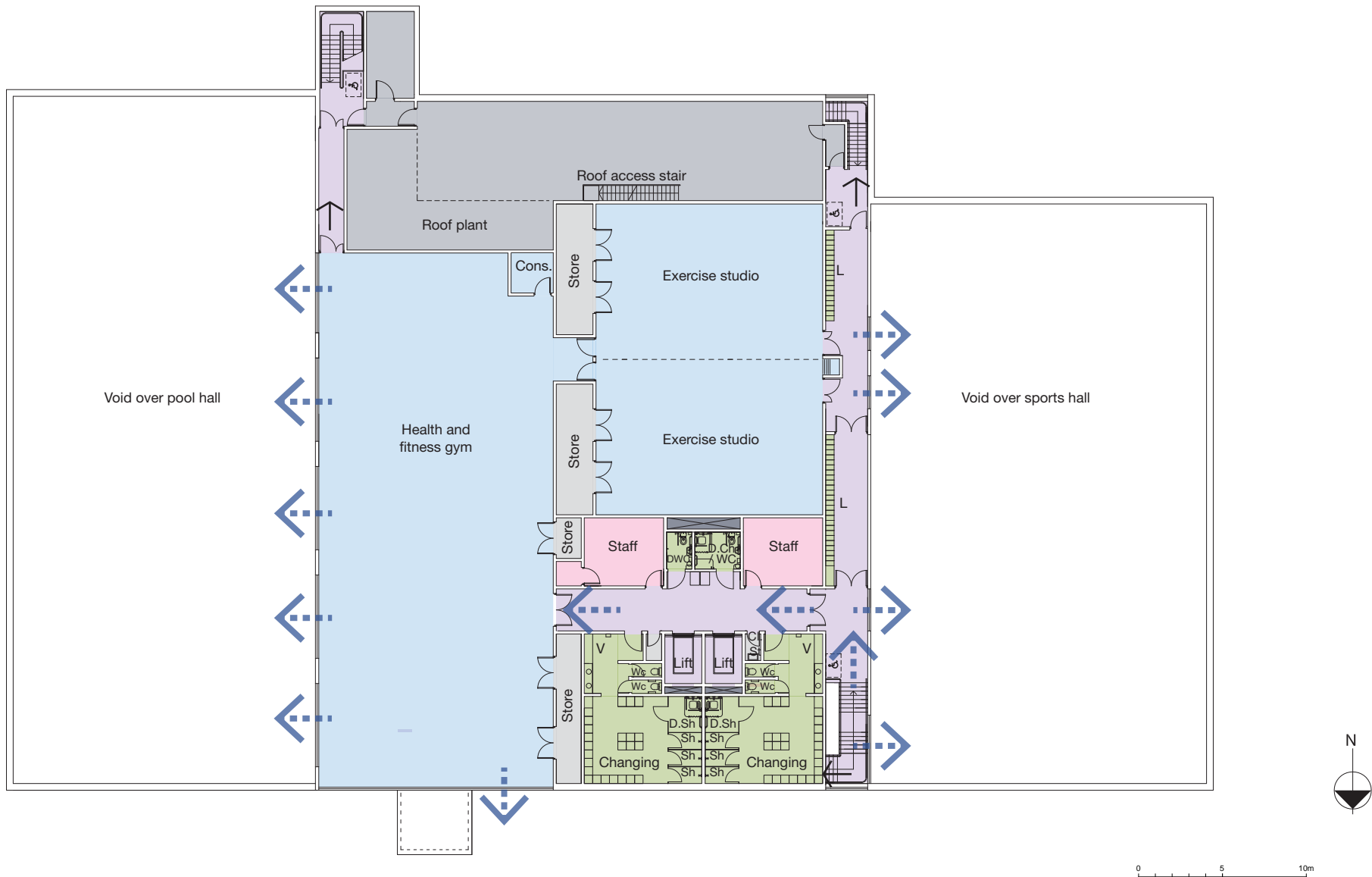
Option C 6 lane swimming pool and secondary pool + 4 court sports hall + 100 station health and fitness gym + 2 studios

Ground floor



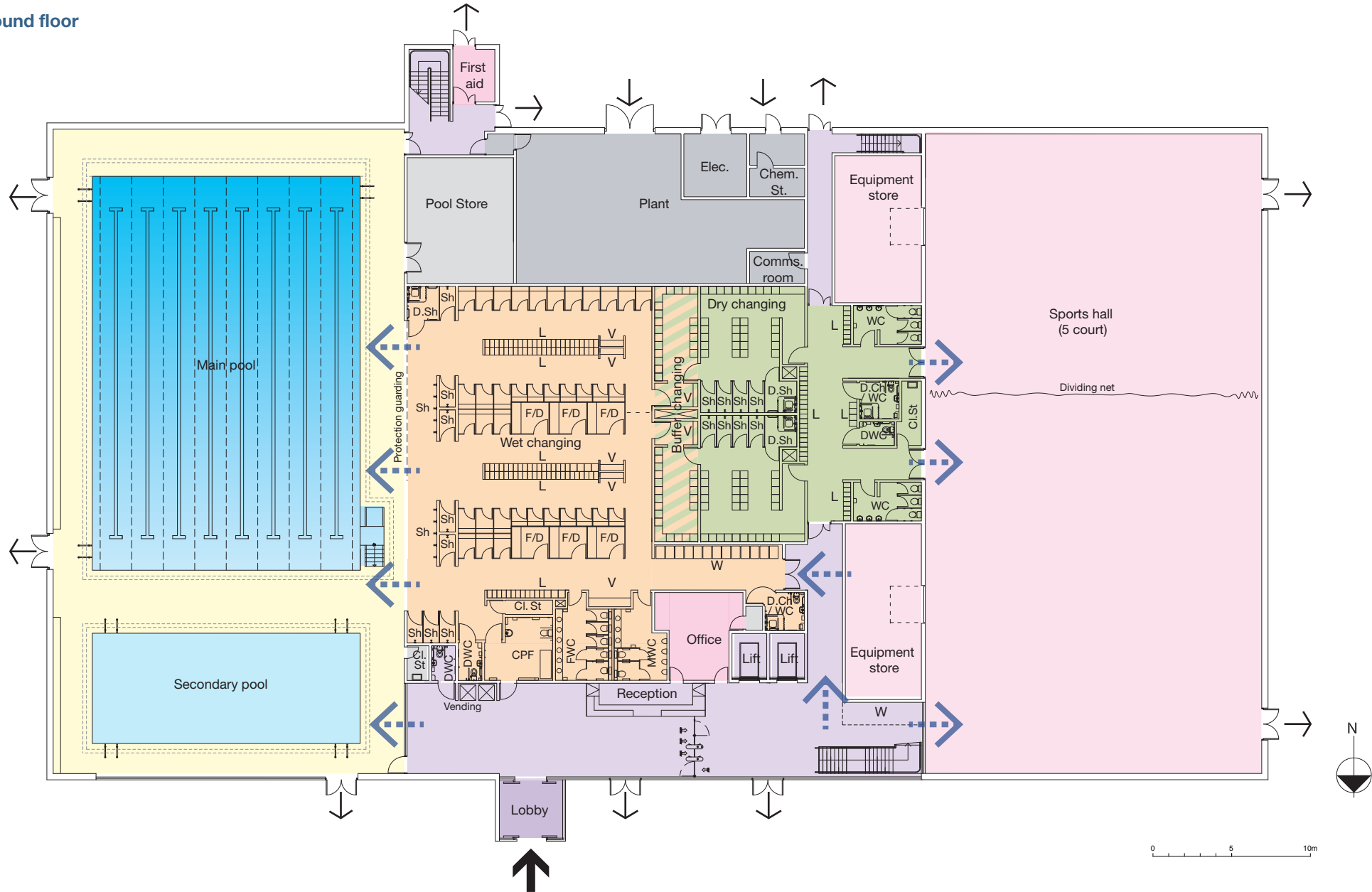
Option C 6 lane swimming pool and secondary pool + 4 court sports hall + 100 station health and fitness gym + 2 studios

First floor



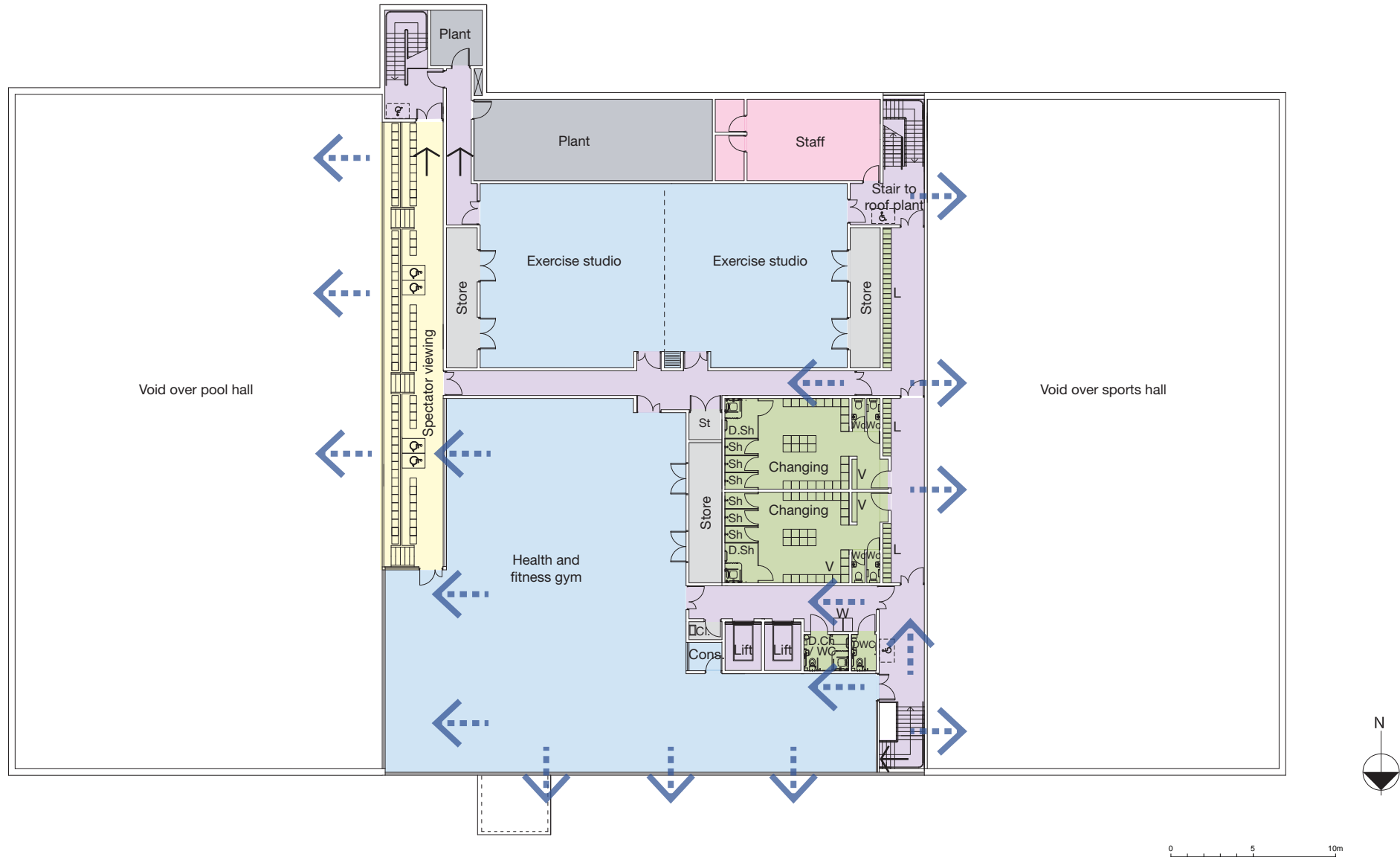
Option D 8 lane swimming pool and secondary pool + 5 court sports hall + 100 station health and fitness gym + 2 studios

Ground floor



Option D 8 lane swimming pool and secondary pool + 5 court sports hall + 100 station health and fitness gym + 2 studios

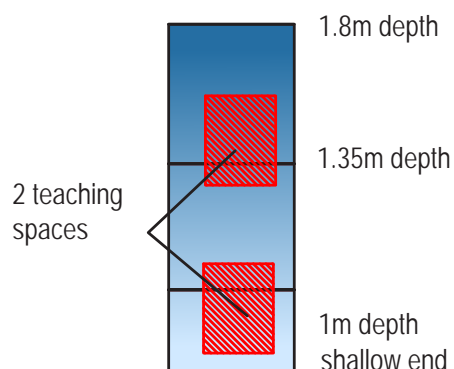
First floor



Appendix 4: Indicative Pool Configurations

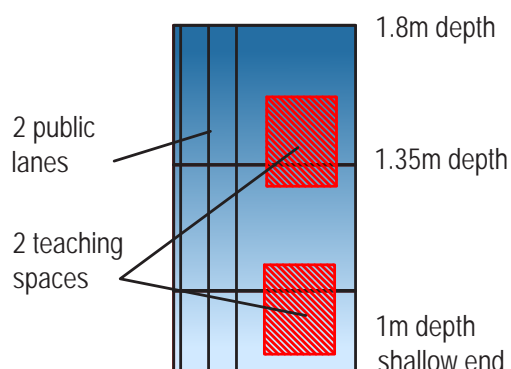
Option A

4 lanes x 25m



Option B

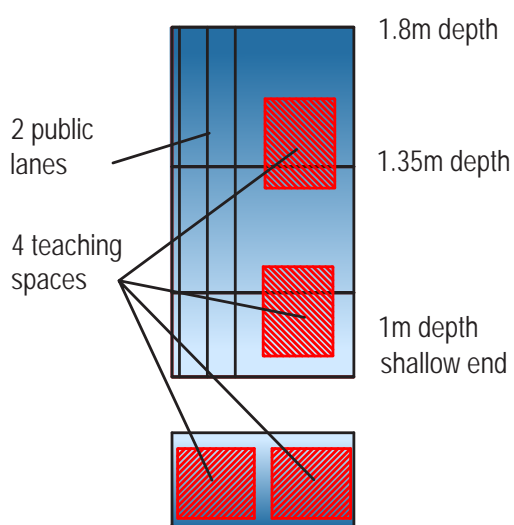
6 lanes x 25m



- Sloping varying water depths
- Lengthways split

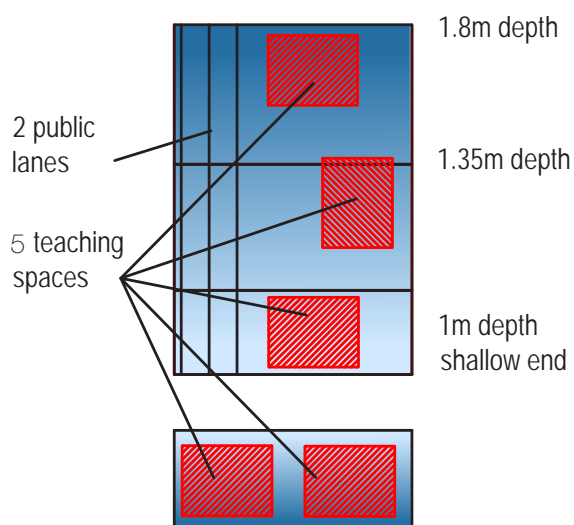
Option C

6 lanes x 25m + learner pool



Option D

6 lanes x 25m + learner pool



Appendix 5: Building fabric

Outline specification notes

(To be read in conjunction with Sport England *Affordable Sports Halls and Affordable Community Swimming Pools* documents)

Element	External finishes
External Walls	<p>The external walls comprise a combination of inner leaf of 140 mm thick concrete blockwork with render and ceramic tiling with 160 mm mineral wool insulation and vapour barrier, suitable for use with outer leafs of facing brick or rendered blockwork or stone and a rain screen system with polyester powder coat finish fixed to a proprietary carrier system complete with breather membrane, 160 mm mineral wool thermal insulation and vapour barrier over an inner leaf of 140 mm blockwork with secondary steel framing.</p> <p>Further options: subject to site-specific requirements.</p> <p>The construction within the pool hall and sports hall to allow for a Reverberation Time (RT) of <1.5 - 2.0 seconds at 500 Hz.</p>
Curtain Walling/ Windows	<p>Proprietary powder coated thermally broken, pressure equalised, aluminium drained and ventilated curtain-walling system. Section sizes to suit individual spans including any necessary additional painted galvanised steel framing. Glass to be double-glazed sealed units, with toughened outer pane and toughened laminated glass inner pane; U-value 1.5w/m²K. Glazing including thermal separation of framework to be in accordance with DIN 4108 or equivalent national standard. Manifestation strips to be incorporated on glazing, where required, to comply with statutory legislation. Such strips to be incorporated at dual height to suit eye heights of both ambulant and wheelchair-bound users. All glass to comply with BS 6206 minimum class A to dry areas and class C to wet areas. Thermal glazing to be the subject of a thermal shading check and where necessary, the outer skin to be toughened. All glass to poolside to be laminated to BS6206. Pool Hall only: Subject to the building's orientation and external landscaping and natural shading, automatic light sensor activated roller blinds just above top transoms to allow specular reflection / glare to be controlled and lighting levels to be maintained in overcast conditions when retracted. Solar control to be provided to all glazing to south and west elevations to all rooms apart from pool hall.</p>
Louvres (external)	<p>Proprietary polyester powder-coated louvres c/w secondary support framework, matching access doors including ironmongery. Free area to be not less than 50% louvre area, to incorporate anti-vermin mesh. Insulated blank off panels to be supplied to the internal face to suit plant installation.</p>
External Doors Generally	<p>Doors (not included as entrance doors or associated with curtain walling, glazed screens or louvres) to be proprietary polyester powder coated galvanised steel door sets with integral ironmongery. Doors to sports hall to include flush steel rebound panels and recessed panic bolts.</p>
Automatic Entry Doors	<p>Polyester powder coated aluminium electro-mechanical bi-parting sliding fully glazed aluminium framed doors with microprocessor control and silent brushless DC motor. Doors to be break-out linked to fire alarm for emergency egress and provided with side screens and pocket screens.</p>
Roof	<p>Standing seam aluminium roof system on mineral fibre insulation (350 mm thickness needed to give required U-value 0.1 W/m²degK) on vapour barrier on acoustic membrane on acoustic insulation batt (for performance see External Walls) adhered to perforated aluminium structural deck. The roof to allow for a Reverberation Time (RT) of <2.0 seconds across a range of frequencies. Roof drainage to incorporate aluminium eaves gutters, insulated where necessary, and aluminium rainwater pipes externally. To include integrated fall restraint system to comply with current legislation with supplementary protection to verges.</p> <p>Further options: subject to site-specific requirements</p>
Rooflights	<p>Proprietary low-rise barrel rooflights with double-skin polycarbonate or similar, glazing cassettes and integral drainage channels on thermally broken insulated builders work kerbs to achieve U-value 1.5 W/m²K</p>

Internal finishes schedule

(To be read in conjunction with Sport England *Affordable Sports Halls* and *Affordable Community Swimming Pools* documents)

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Entrance Lobby	Ceramic tile slip resistant, (+40 PTV Slider 96) on fine concrete screed, min thickness 75 mm on structural slab Entrance matting	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	Soffit: British Gypsum 12.5 mm MR grade featheredged plasterboard & drywall coating. Vapour barrier and 150 mm cavity fill insulation.	Polyester powder coated aluminium thermally broken double glazed screens. U value 1.5 W/m ² K.	Doors thermally broken double glazed U value 1.5 W/m ² K. All glass to be toughened to meet Class A BS6206. Polyester powder coated aluminium electro-mechanical bi-parting sliding fully-glazed aluminium framed doors with microprocessor control and silent brushless DC motor. Doors to be breakout linked to fire alarm for emergency egress and provided with side screens and pocket screens.	Recessed mat well c/w aluminium frame to suit 19 mm barrier matting.	N/A
Foyer & Reception Desk Area	Ceramic tile slip resistant, (+40 PTV Slider 96) on fine concrete screed, min thickness 75 mm on structural slab	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	White mineral fibre lay-in acoustic tile 600 x 600 mm tegular edged in white lay-in grid. Reception desk area: Perimeter margin 300 mm plasterboard feature with dropped bulkhead over desk with white mineral fibre lay-in acoustic tile 600 x 600 mm tegular edged in white lay-in grid.	Polyester powder coated aluminium thermally broken double glazed curtain walling and screens (internal and external) U value 1.5 W/m ² K Glazed screen to Sports Hall - flush faced on the Sports Hall side. All glass will be designed to BS6399 for impact by players. Glass to be toughened to meet Class C BS6206 (laminated to pool hall)	Internal doors veneered solid core doors minimum 30FS rated c/w stainless steel ironmongery and twin vision panels in circulation areas solid elsewhere. Sliding doors to glazed screen thermally broken double glazed U value 1.6 W/m ² K. All glass to be toughened to meet Class A BS6206. Polyester powder coated aluminium Electro-mechanical bi-parting sliding fully-glazed aluminium framed doors with microprocessor control and silent brushless DC motor. Doors to be breakout linked to fire alarm for emergency egress and provided with side screens and pocket screens.	Recess for vending machines. Services for vending machines to client supply. Notice boards. Reception desk and servery counter with dropped accessible sections for wheelchair use from both sides of the desk. Reception desk to incorporate suitable task lighting, storage cupboards/drawers (lockable), comms/power/IT/PO integrated services. Automatic turnstiles with card swipe access control and manual control from reception desk. Disabled persons access gate linked to access control. Induction loop. Viewing panel from office with two-way mirrored glass.	Hardwood 144 x 19mm

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Offices	Power floated concrete slab with 500 x 500 mm heavy duty commercial carpet tiles on tack adhesive - latex slab if required.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm in white lay-in grid.	Polyester powder coated aluminium thermally broken double glazed windows. Opening fanlights. U value 1.5 W/m ² K	Internal doors solid core, veneered with stainless steel ironmongery. 30FS rated.	Viewing panel from Reception with two-way mirrored glass. Dado trunking wired for power, data and communications. Furniture (client supply). Provision for assistance dogs resting / tethering point.	Hardwood 144 x 19mm
Sports Hall	Power floated concrete slab with an area elastic structured timber sprung floor to meet BSEN 14904. Depending on the primary sports to be played, point elastic or combined point elastic and area elastic flooring could be considered.	Lower level of sports hall formed with fire rated rebound panels on battens fixed to cladding rails. Upper wall consisting of acoustic insulation panels fixed to the inner lining of the composite wall cladding as required to contribute to < 2.0 sec reverberation time. Wall protection curtain/ netting fixed to all upper sports hall walls to give semi opaque unified wall colour (to match the lower rebound wall) and light reflection value	Exposed steel roof structure painted with web-perforated structural liner sheet finish white to provide acoustic performance as required.	The glazed screen to the sports hall will be flush faced on the sports hall side. All glass will be designed to BS6399 for impact by players. Glass to be toughened to meet Class C BS6206	Doors to glazed screen glazed and be flush on sports hall side. All glass will be designed to BS6399 for impact by players. Glass to be toughened to meet Class C BS6206.	Fixed sports equipment included - Drop down basketball goals x 2. Wall fixed practice basketball goals x 8. Floor sockets for Netball x 1; Badminton x 5, Volleyball x 1, Cricket netting and track, division netting & track x 1. All as shown in <i>Affordable Sports Halls</i> publications for size of hall.	Part of rebound boards
Sports Hall equip. Store	Power floated concrete slab with 2 coats of clear floor hardener and dust proofer	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	Exposed soffit	N/A	Proprietary up and over doors c/w plywood facings to match sports hall rebound surface. 2.4 x 2.4 m	All loose and fixed equipment excluded	N/A
Dry Changing	Ceramic tile slip resistant, (+40 PTV Slider 96 and PTV 55/96) on fine concrete screed, min thickness 75 mm on structural slab.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm tegular edged impact & high moisture resistant mineral tiles in white grid.	N/A	Internal doors solid core, veneered with stainless steel ironmongery. 30FS rated.	Benching & coat hooks - benches generally 500 mm deep. 2 m run x 600 mm deep. Mirror. Grab rails and hinged rails for ambulant disabled. Magnetic white board 1.8 x 1.2 m.	Coved ceramic tile.

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Dry Changing Showers	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding, surface applied DPM to entire wall surface. Finish ceramic tile full height. Alternatively, concrete block partitions with full height ceramic tiling can be considered.	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm tegular edged impact and high moisture resistant mineral tiles in white, anti-corrosion, galvanised and polyester powder coated grid.	N/A	N/A	Shower fittings. Shower cubicles generally 2.0 x 1.0 m compact grade laminate dividers, pilasters and doors c/w stainless steel hinges, feet, indicator bolt, towel hook. 1no. 2.0 x 2.2 m accessible shower cubicle with grab-rails, hinged rails and seat.	Coved ceramic tile.
Dry Area Toilets	Ceramic tile slip resistant, (+40 PTV Slider 96) on fine concrete screed, min thickness 75 mm on structural slab.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm tegular edged impact & high moisture resistant mineral tiles in white grid.	N/A	Internal doors solid core, veneered with stainless steel ironmongery. 30FS rated.	Sanitaryware: 3 x WC (1 with ambulant disabled grab rails), 2 x wash hand basin, 3 x compact grade laminate cubicles c/w coat hook, indicator bold, leg, T.Roll holder, hand drier(s). Mirror.	Coved ceramic tile.
Dry Area Unisex Accessible WC * (Ground and First Floors)	Ceramic tile slip resistant, (+40 PTV Slider 96) on fine concrete screed, min thickness 75 mm on structural slab.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish. Ceramic tiled splash back to basin.	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm tegular edged impact & high moisture resistant mineral tiles in white grid. (Sun-pipe rooflights at first floor levels).	N/A	Internal doors Solid core, veneered to corridor plastic laminated to room with stainless steel ironmongery. 30FS rated.	Proprietary rooflight. Sanitaryware: Full Doc M Toilet pack T.Roll holder, hand drier. Mirror. Fold down baby changing table.	Coved ceramic tile.
Dry Area Unisex Accessible Changing Room * (Ground and First Floors)	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding, surface applied DPM to entire wall surface. Finish ceramic tile full height	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm tegular edged impact & high moisture resistant mineral tiles in white grid. (Sun-pipe rooflights at first floor levels).	N/A	Solid core, veneered to corridor plastic laminated to room with stainless steel ironmongery. 30FS rated.	Proprietary rooflight. Sanitaryware: Full Doc M Toilet & Changing/Shower pack T.Roll holder, hand drier. Mirror.	Coved ceramic tile.

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Wheelchair / Buggy Storage / Shoe Change Areas	Ceramic tile slip resistant, (+40 PTV Slider 96) on fine concrete screed, min thickness 75 mm on structural slab.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	White mineral fibre acoustic lay-in ceiling tiles 1200 x 600 mm in white lay-in grid.	N/A	N/A	Storage c/w rail and locks.	Hardwood 144 x 19mm
Dry Area Circulation (Ground and First Floors)	Ceramic tile slip resistant, (+40 PTV Slider 96) on fine concrete screed, min thickness 75 mm on structural slab.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	White mineral fibre acoustic lay-in ceiling tiles 1200 x 600 mm in white lay-in grid. (Sun-pipe rooflights at first floor levels).	N/A	Solid core, veneered with stainless steel ironmongery. 30FS rated c/w twin vision panels in circulation areas, solid elsewhere.	Lockers 500 x 300 mm lockers on plinth Guard rails to Sports Hall glazed doors	Hardwood 144 x 19mm
Fitness Gym	Fitness Gym Areas: Power floated concrete slab. 80% of floor area to have 500 x 500 mm commercial carpet tiles - one colour to equipment areas and one colour to circulation areas. 20% of floor area to have Free Weights mats - IDASS interlocking high density mats c/w ramped edges.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	Full height space - exposed steel roof structure with exposed galvanised purlins painted and fully perforated profiled liner sheet finish white. Proprietary rooflights	Polyester powder coated aluminium thermally broken double glazed windows. Opening fanlights. U value 1.6 W/m2K	Solid core, veneered with stainless steel ironmongery. 30FS rated c/w twin vision panels in circulation areas, solid elsewhere.	One wall - continuous mirrors made up of 2.0 x 0.9 m panels fixed to wall.	Hardwood 144 x 19mm
Fitness Changing	Ceramic tile slip resistant, (+40 PTV Slider 96) on fine concrete screed, min thickness 75 mm on structural slab.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm tegular edged impact & high moisture resistant mineral tiles in white grid.	N/A	Solid core, veneered with stainless steel ironmongery. 30FS rated c/w twin vision panels in circulation areas, solid elsewhere.	Proprietary rooflight. Benching & coat hooks - generally 500 deep with 1no. 2 m run x 600 deep. Mirror. Grab rails and hinged rails for ambulant disabled to one bench.	Coved ceramic tile.
Fitness Changing Showers	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding , surface applied DPM to entire wall surface. Finish ceramic tile full height	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm tegular edged impact and high moisture resistant mineral tiles in white, anti-corrosion, galvanised and polyester powder coated grid.	N/A	N/A	Shower fittings. Shower cubicles generally 2.0 x 1.0 m compact grade laminate dividers, pilasters and doors c/w stainless steel hinges, feet, indicator bolt, towel hook. 1no. accessible shower cubicle with grab-rails, hinged rails and seat.	Coved ceramic tile.

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Fitness Studio	Power floated concrete slab with an area elastic structured timber sprung floor to meet BSEN 14904. Depending on proposed usage, vinyl floor finish could also be considered.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish.	Full height space - exposed steel roof structure with exposed galvanised purlins painted and fully perforated profiled liner sheet finish white. Proprietary rooflights.	Polyester powder coated aluminium thermally broken double glazed windows. Opening fanlights. U value 1.5 W/m ² K	Solid core, veneered with stainless steel ironmongery. 30FS rated c/w twin vision panels in circulation areas, solid elsewhere.	One wall - continuous mirrors made up of 2.0 x 0.9 m panels fixed to wall above skirting. Wall fixed barre.	Hardwood 144 x 19mm
Fitness Studio / Fitness Gym Stores	Power floated concrete slab with slip resistant 2.5 mm vinyl sheet flooring with matching coved PVC or timber (painted) skirtings - latex slab if required.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding. Painted 1 mist + 2 coats vinyl matt emulsion.	White mineral fibre acoustic lay-in ceiling tiles 1200 x 600 mm in white lay-in grid.	N/A	Internal doors Solid core, veneered with stainless steel ironmongery. 30FS rated.	Loose and fixed fitness and dance equipment otherwise excluded. Portable sound system excluded.	Hardwood 144 x 19mm
Dry Cleaners store	Power floated concrete slab with slip resistant 2mm vinyl sheet flooring with matching coved skirtings - latex slab if required.	Severe duty partition - metal stud to suit building height c/w 25 mm mineral fibre acoustic insulation. 12.5 mm WBP plywood backing board, moisture resistant proprietary plaster boarding with paint finish. Ceramic tiled splashback to sink.	White mineral fibre acoustic lay-in ceiling tiles 600 x 600 mm tegular edged impact & high moisture resistant mineral tiles in white grid.	N/A	Solid core veneered to public area laminated to room minimum 30FS rated c/w stainless steel ironmongery	Belfast sink with bucket grating. H&C water bib taps. Shelving to be provided by operator	Coved skirting part of flooring

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Swimming Pool Hall	<p>General: Pool tank and surround construction is taken as reinforced water retaining concrete with tile on screed and render. 100mm thermal insulation to pool tank walls. Alternatively, a stainless steel pool walls on concrete base with tiled concrete pool surround or a proprietary sprayed concrete pool tank constructed to similar criteria as reinforced concrete with tile finish and tiled concrete pool surround.</p> <p>The pool tank profile to be in compliance with Sport England Guidance.</p> <p>Surround: Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to channel on fine concrete screed, min thickness 75 mm, water retaining concrete slab.</p> <p>Pool drainage channels: To accommodate the requirements of BS15288 part 1. Provide proprietary pockets for movable hoist.</p> <p>Pool tank: Ceramic tiles, on screed to concrete pool base slab and rendered concrete walls.</p>	<p>Ceramic tiles to 2.0 m above floor level. Internal walls to other spaces to achieve U value 0.2 W/m²K eg. 140 mm blockwork 160 mm mineral wool insulation, drylined plaster board with painted finish.</p>	<p>Proprietary perforated aluminium roofing system with acoustic quilt to play part of < 2.0 sec reverberation time. Painted structural steelwork.</p>	<p>Curtain walling. Option of electrically operated translucent privacy blinds fixed to the transoms at a suitable height and run in guides fixed to mullions. Blinds and mechanism to be suitable for use in the pool hall environment. Subject to location and orientation the glazing designed to avoid glare a specular reflection on the surface of the pool water.</p>	<p>Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery, may also be installed as an option to close the pool hall from the changing rooms at the end of the day.</p> <p>External: Glazed aluminium frame doors as part of curtain walling.</p>	<p>Recessed pool steps with stainless steel handrails. Wall mounted insulated pool covers or insulation included into the movable floor.</p> <p>If it is intended that timing equipment be used, the pool tank length is to be adjusted to accommodate the timing pads and the tolerance on pool tank length is to be in accordance with the latest edition of the FINA Facilities Regulations.</p> <p>Easy access steps with stainless steel handrails. Electric wheelchair lift / lifting plane to allow wheelchair users to access the water unaided. Lane rope holders / fixings. Halfway, false start, and backstroke markers.</p>	<p>Coved ceramic tile.</p>

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Pool Store	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on water retaining concrete slab as pool surround.	Painted concrete blockwork	None - exposed soffit	N/A	Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery.	Racking and shelving.	Coved ceramic tile.
Pre-Swim Showers	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on water retaining concrete slab as pool surround.	Ceramic tiles (full-height)	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be anti-corrosion galvanised & polyester powder coated.	N/A	N/A	Shower heads served with pre mixed water activated by movement sensor. Doc M shower pack.	Coved ceramic tile.
Post-Swim Showers	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tiles (full-height)	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be anti-corrosion galvanised & polyester powder coated.	N/A	N/A	Shower heads served with pre mixed water activated by movement sensor. Doc M shower pack.	Coved ceramic tile.
Wet Unisex Accessible WC	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tile to 2.3 m above floor level. Painted render above.	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be anti-corrosion galvanised & polyester powder coated.	N/A	Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery.	Sanitary ware. 1no. Doc M toilet pack. 1no. warm air hand dryer. 1no. full-height safety mirror. Fold down baby changing table	Coved ceramic tile.
Wet Unisex Changing Places Facility	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tile to 2.3 m above floor level. Painted render above.	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be anti-corrosion galvanised & polyester powder coated.	N/A	Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery.	Hoist for peninsular rooms fixed to structure over. Sanitary ware. Doc M shower pack. Doc M toilet pack. Warm air hand dryer. Safety mirrors, one full height.	Coved ceramic tile.

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Unisex Accessible Changing Room	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tile to 2.3 m above floor level. Painted render above.	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be anti-corrosion galvanised & polyester powder coated.	N/A	Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery.	Sanitary ware. Doc M shower pack. Doc M toilet pack. Warm air hand dryer. Safety mirrors, one full height.	Coved ceramic tile.
Wet Male and Female Toilets	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tile to 2.3 m above floor level. Painted render above.	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be anti-corrosion galvanised & polyester powder coated.	N/A	Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery.	Cubicles: Compact grade laminate cubicles fully framed with anodised aluminium framing. Sanitary ware: Vanity top to accommodate inset wash hand basins (WHB) with premixed water supplied by percussion taps with wall mounted safety mirrors to BS6206 Class A. Doc M packs: For ambulant access to one wc and urinal.	Coved ceramic tile.
Wet Changing Rooms	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tile to 2.3 m above floor level. Painted render above.	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be anti-corrosion galvanised & polyester powder coated.	N/A	Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery.	Cubicles: Compact grade laminate cubicles fully framed with anodised aluminium framing. Sanitary ware: Lockers: (On a coved tiled concrete plinth): Mixed single, double and treble split height lockers with aluminium bodies and solid grade laminate doors with coin return key operated locks. Component design to be in full compliance with Sport England Guidance. Vanity top: To accommodate hair dryers. Wall mounted safety mirrors: To BS6206 Class A.	Coved ceramic tile.

Room	Floor	Walls	Ceiling	Glazing	Doors	Fittings	Skirting
Wet Cleaner's Store	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tile to 2.3 m above floor level. Painted render above.	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be anti-corrosion galvanised & polyester powder coated.	N/A	Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery.	Cleaners sink bucket grate, bib taps. Shelving.	Coved ceramic tile.
Wet Circulation	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tile to 2.3 m above floor level. Painted render above.	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed anti-corrosion grid, support system to be galvanised & polyester powder coated	N/A	Solid GRP door sets, warranted for use None in wet areas with factory fitted ironmongery.	To operator's requirements for e.g. buggy storage	Coved ceramic tile.
First Aid Room	Designated wet floor with ceramic tile slip resistant, (+40 PTV Slider 55/96). Laid to max fall 1/40 to floor drainage gully on fine concrete screed, min thickness 75 mm, on continuous dpm on structural slab.	Ceramic tile to 2.3 m above floor level. Painted render above.	600 x 600 mm moisture resistant mineral fibre ceiling tiles in semi-concealed grid, support system to be galvanised & polyester powder coated	N/A	External doors - proprietary steel door sets. Internal doors - Solid GRP door sets, warranted for use in wet areas with factory fitted ironmongery.	Kitchen wall and base fittings with inset sink and taps. Lockable equipment cupboard. Stretcher / trolley / bed / chair all Client supply items.	Coved ceramic tile.
Plant Rooms Generally	Power floated concrete slab and stairs with 2 coats of clear floor hardener and dust proofer. Open steel grid flooring with removable section to BS 5395.	Fair faced blockwork with dust inhibitor	Exposed steel roof structure painted with web-perforated structural liner sheet finish white.	N/A	Painting grade solid core doors minimum 30FS rated c/w stainless steel ironmongery. Weathered louvre door integrated into louvred panel c/w locking mechanism.	Balustrade to access stair. Galvanised steel 48 dia steel tubular handrail, midrail and balusters at max 1500 mm c/c, c/w palm fixings to concrete. 0.9 m high to flights 1.1 m high to landings. Galvanised steel ladders/companion stair/mezzanine floor with galvanised steel open grid finish, toe plate and handrails to meet BS 5395.	N/A

Fixtures, fittings and equipment schedule

Item		
Reception desks	WC, changing, shower cubicles	Disabled access hoist
Automatic turnstiles	Fitness studio mirrors	Pool access ladders
Servery	Dance studio rail	Pool clock
Fixed seats suitable for pool hall	Mirrors to WC and changing	Access handrails
White boards / notice boards	Vanity units	Pool lane ropes and anchor points
External guard rails to automatic doors	Hairdryers	Lane rope trolleys
Benching and clothes hooks	Lockers	Basketball: electrical operated roof mounted units
Hand dryers	Shelving to stores and cleaner's cupboards	Basketball: 8 no. practice basketball goals
Baby change facility	Hooks for equipment storage	Cricket netting: 2 no. lanes, including full with back net
First aid room fit-out	Internal signage	Central division netting
	External signage	Cleaning machine

Appendix 6: Structural Design and Drainage

Key affordable assumptions

(within the indicative designs and costings)

- The building comprises a braced steel frame with traditional pad foundations
- In-situ, reinforced concrete, water retaining tanks with compliance testing (in some circumstances other options may be possible with careful consideration (see page 27)
- Design and construction organisations with proven previous experience
- Comprehensive geotechnical investigations
- Appropriate structural materials for a 60 year+ life including the swimming pool environment, e.g. structural steel frame and concrete floors and foundations
- Very early coordination with specialist building features such as movable floors and booms
- Discharge rates to foul and surface water to be agreed with drainage authorities.

General

This section considers the basic design parameters for the structural design and drainage of swimming pools and highlights the specific issues that relate to 25 m pools.

The following has been assumed in the development of the indicative structural designs and associated cost estimates:

- **Ground conditions:** The ground bearing strata is well-compacted granular material, homogeneous across the site area with a bearing capacity of 150 kN/m². Soil density is assumed to be 19 kN/m³ with the angle of shearing resistance - 35°.
- **Ground water conditions:** The lowest level of foundation, basement or pool tank is assumed to be above the highest seasonal ground water level. Floatation of the pool tanks / basements has not been considered in this indicative design.

- **Basic snow loading:** The assumed snow loading is 0.6 kN/m².
- **Wind loading:** Assumed basic wind speed 23 m / sec, site altitude - less than 300 m, effective height of building - less than 6.5 m and the maximum dynamic pressure - not greater than 1.5 kN/m².
- **Steel grade for steel framing:** S355
- **Concrete grade:** C32/40 with a density of 25kN/m³

General engineering requirements

As with any large structure a 25 m pool and associated buildings need to be designed to cater for the traditional loads imposed for its location.

The design of the building structures also needs to take into account the life span of the structure in conjunction with other elements of the building. In particular it should be noted that the mechanical and electrical (M&E) installations will probably have a much shorter life and full replacement might be expected at, say, 20 - 25 years. Ideally, the structure of the building should be designed to facilitate this.

Early design considerations

In addition to the above, swimming pool buildings are very highly serviced with traditional M&E, filtration equipment, associated balance tanks and distribution pipework, specialist equipment associated with any competition use of the pool, e.g. timing pads, movable floors and booms, underwater sound, lighting and cameras, etc. Early meetings must take place with the client together with specialist consultants and subcontractors to determine the effect that these elements could have on the structure and therefore cost. Accessibility requirements also need to be considered at very early stages so that requirements can be incorporated into the pool tank arrangements.

Geotechnical investigation

A comprehensive Geotechnical study should be undertaken including a Phase 1 Desk Study and a Phase 2 intrusive survey. Where appropriate, this would also include a Flood Risk Assessment. The Phase 2 intrusive survey should include groundwater level information.

If groundwater levels are shallow then seasonal monitoring should be undertaken as groundwater levels will be critical in the assessment of potential floatation of the below ground pool tanks. The Geotechnical Investigation must also provide a detailed assessment of the likely differential settlement in the pool tank areas given the loading from the pool tanks (see below).

Differential settlements and movement

Different parts of the structure will be more or less tolerant to settlement and movement of the structure. This should be assessed by traditional design methods taking into account the finishes to the building. The swimming pool tanks will need to be considered separately. With 'level deck' construction the effects of any differential settlement around the pool tank are very visible. The design should allow for the effects of settlement when the pool tanks are emptied and filled, e.g. taking into account the typically brittle nature of the finishes to the pool tank and the surrounds.

If there is a requirement to cast the base of the pool tank on insulation, the structural designer must assure himself that the long term compressibility of the insulation, possibly in wet chlorine contaminated environment, would not result in differential settlement that could alter the flow paths into a level deck channel.

Tolerances in construction

Normal building tolerances will apply to the building generally (except where special finishes might be required), but special tolerances will apply to the main pool tank. If a 25 m pool tank is to be constructed as a competition pool rather than as a community pool, more stringent tolerances would apply to the length of the tank and the flatness and verticality of the end walls. The level of competition should therefore be agreed with the client.

If movable floors and booms are to be included in the design of the pool, the tolerances of the whole tank should be discussed with the floor and boom supplier to confirm that the required accuracy can be achieved both in terms of the fit of the components within the tank and in relation to any competition requirements.

Once the level of tolerance is determined, it is important for the design team to determine how this tolerance will be achieved. The final accuracy can be obtained using rendered finishes and the tiling but, to determine the size of the pool tank structure, it is necessary to establish whether all the pool tank walls will be rendered.

Structural Engineering considerations

Foundations

The construction of foundations should allow for routing of underground services especially filtration and drainage pipework.

The foundation solution needs to take into account the settlement requirements for the building frame and the additional more onerous requirements for a level deck channel around the 25 m pool. The foundation solutions for the two parts of the building may well be different based on the settlement characteristics of the substrate at formation level. For example, the frame of the building might be built on pad foundations but the pool tank may be piled to counter differing local ground bearing pressures over the area and depth of a 25 m pool.

If the pool tank is piled then the structural solution must take into account the differing loads on the piles by adjusting the pile centres to ensure that the loads on all piles are similar. Alternatively, the pile designer should ensure that the settlement of piles with different loads is similar. Safety factors on pile loads should be agreed with the specialist subcontractor.

Consideration will also need to be given to the depth of excavation required for the pool tanks and the construction of the adjacent foundations. Deep tanks with diving facilities or retractable deep boom slots can be difficult to construct, especially on confined sites. To avoid large battered excavations, consideration should be given to sheet piling or contiguous piles to secure the excavation.

Deep swimming pool tanks should also be reviewed for floatation against groundwater level information provided by the Geotechnical specialist.

Filtration plant room

For the affordable model, a basement filtration plant room is assumed designed to allow filter and other plant replacement. Structurally, the basement would be built in in-situ concrete with pumped drainage. Externally, basement tanking details need to be carefully considered to ensure long term serviceability of the plant room space.

If the available site layout allows, locating the filtration plant room at ground floor level may, in certain circumstances, prove more economic and allow easier maintenance and replacement of the large and heavy filters.

In this case, a recessed pump pit is normally provided in the floor, typically 1.2 m deep (therefore below pool water level), to ensure flooded suction is achieved in the filtration pumps. In either case, lifting beams would be provided for easy access.

A separate chemical store should be provided with a sealed floor and bund to prevent spillage and a sump so that any spillage can be removed.

Traditional plant rooms

Mechanical plant rooms should be located to suit the air distribution in the building. Ideally, the Building Services Engineer should consider locating smaller plant rooms around the building so that the size of air distribution ductwork does not become overly large, with long runs from the plant room to the point of delivery. If this were the case, then air handling ductwork can dictate the depth of ceiling voids and therefore floor to floor heights. Large ducts can also be very disruptive to the structural zones in floors and at roof level.

Electrical plant rooms

It is important to understand at the very early stages where the electrical switch rooms are likely to be and especially whether a substation will be incorporated into the building envelope.

Design of swimming pool, pool surrounds and balance tanks

General arrangement of swimming pool tanks

The design of 25 m pool tanks is usually undertaken in shuttered, water retaining, reinforced concrete. This is done for both robustness of construction and durability. Sprayed concrete can be used successfully to create tanks that comply with crack width requirements and is very useful if there are any 'free form' walls in the development. However, for a rectangular 25 m tank, very careful planning and the early engagement of specialists is essential if this type of construction is to be successful.

A well designed and detailed tank of this nature would be expected to give a minimum life of 60 years. Other options are available, in particular the use of stainless steel tanks designed by a specialist to similar criteria as the concrete option, although life spans may be significantly shorter.

The general arrangement drawings need to take into consideration the main elements that will be incorporated into the design. For example:-

- Filtration associated works: early liaison with a pool filtration specialist is essential to determine the location and size of balance tanks, the rate of backwash discharge, the set out of the flow return sumps in the base of the tank, the size and shape of the level deck channel for the return water to the filters and the route of the delivery pipework from the filtration plant room to the pool tank.
- The arrangements for access to the pool so that the location of steps, platform lifts, etc. can be incorporated into the pool tank design.
- The location and detail of the proposed access ladders into the tank. In addition whether the tank will have a 'rest ledge', this is usually 1200 mm below water level.
- Details of any movable floor and boom need to be understood at the very early stages of design development as the depth of movable floor will dictate the overall depth of the pool tank (or part thereof) and the type of boom. The booms can be a floating boom 'docked' at the end of the tank in which case the length of the pool will need to be 25 m, plus the boom width.

Alternatively, the boom could sit in a trench below the floor of the main pool tank. The type of movable floor construction is also important in order to establish the location of any cables or rams through pool tank walls or otherwise.
- The use of the pool and level of any competition requirement will need to be established at the early stages of design to enable the plan tolerances of the construction to be confirmed. This might also dictate whether a permanent upstand for starting blocks is required for each racing lane. If so, this is usually constructed from reinforced concrete.
- The location and installation requirements for lane ropes (and their storage) and timing pads is required.
- The falls to the pool surround slabs needs to be carefully considered as it is good practice to provide a separate 'foul' drainage channel in the pool surround slab to cater for wash down water (BS EN 15288: Part 1:2008). It is not normally accepted that 'dirty' wash down water can be returned to the level deck channel and through the filtration system. The drainage pipework required to take the flow from this drainage channel would normally be suspended from the underside of the pool surround slab as, due to its length, falls are likely to be very shallow.
- Earthbonding of reinforcement.

Manholes in pool surround slabs should be avoided wherever possible as they look unsightly, create maintenance issues and interfere with the pool surround falls and tiling layouts.

- Other requirements that could affect the concrete structure of the tank include temporary starting blocks, underwater speakers, underwater lighting, underwater cameras, pool covers, etc.

The design of swimming pool tanks

The design of the water retaining elements should include the pool tanks, the balance tank(s), the pool surround slab and a 150 mm (min) upstand that encloses all the wet areas to provide full containment. Other areas such as wet changing areas, showers, etc. should be similarly bunded and tanked to the Architects details.

The design of the water retaining elements must take into account conventional loadings applied to the structural elements and construction loads. For a swimming pool tank it is normally considered that the worst load case would be when the tank is empty, the area below the pool surround (outside the tank) is backfilled and a construction surcharge load is applied. In addition to the conventional loadings, these elements must also be designed as water retaining to BS EN 1992-3, using a maximum crack width of 0.2 mm¹.

Pool surround slabs should be designed as water retaining suspended slabs, as it is considered that backfill below the slab would not provide a settlement free support.

In recent times it has become more prevalent to use the services of a specialist to design concrete mixes with additives that assist the water retaining properties of the concrete. Whilst this is not strictly necessary, and well-designed traditional concrete will suffice, it can give comfort to main contractors who consider that the pool tank and testing of the tank is critical to the construction programme. In this circumstance, they may be prepared to pay the premium that such a service attracts.

Detailing of the reinforcement in concrete tanks must also be given careful consideration particularly at corners where larger moments can be generated in deep tanks. In general, a well detailed tank with appropriate cover to the reinforcement would require no additional protection such as using galvanised reinforcement.

¹ Although lower limits are considered more appropriate for brittle finishes in swimming pools.

Joists in the pool tank and pool surrounds and casting the pool tank

The pool tanks and surrounds should be cast in reinforced in-situ concrete without joints other than construction joints.

The proposed areas of floor and wall to be poured should be discussed with the main contractor, his subcontractor and the designer to ensure that the size of pour is feasible and that the size and aspect ratios of the pours would inhibit shrinkage cracking. The sequence of pour should be agreed. All construction joints must include a water bar (hydrophilic is preferred) placed strictly in accordance with the manufacturer's instructions.

Mix designs for water retaining concrete should be a designed C32/40, with w/c ratio and cement content generally in accordance with the requirements of grade C35A specified in BS8007:1987.

Pool tank testing

Testing the pool tank is critically important and an approved method of testing is set out in BS8007:1987. This method of testing should be followed precisely and the consequences of the failure of this test on the construction programme must be discussed with the main contractor. This may influence decisions made about the choice of subcontractor and the proposed method of working.

Structural framing of the pool building and associated facilities

The most common form of construction for this type of building is a braced steel frame using composite construction where appropriate (see below). The steel frame should be traditionally designed to carry the dead and imposed loads. The frame should also be designed to suit any deflection requirements that might be given by special finishes, e.g. glazing.

In pool halls and wet areas the steelwork should be detailed to ensure that there are no hidden crevices or dead areas where a build-up of chlorine rich residue can accelerate the onset of corrosion.

Anti-corrosive protection

All columns in wet areas (including changing rooms / villages) and filtration (wet) plant rooms must have concrete encasement to a minimum height of 150 mm above the finished floor level.

The paint build up that provides the protection of the steelwork (not the decorative finish) must extend a minimum 300 mm below finished floor level. Concrete encasement must have a sloping surface away from the steelwork and the joint between the concrete and steelwork formed by shrinkage must be sealed with a suitable chlorine tolerant flexible sealant.

Paint protection to give life to first maintenance of 25 years should be in line with the recommendations of the Corus paint protection guide system number C4/S2 or S3.

Galvanised issues: galvanising can readily be used in a pool atmosphere but similar to stainless steel it is prone to staining if not cleaned. Detailing of the galvanised steel is important in wet areas as loss of galvanising can occur where metals with different electro-potentials touch.

Stainless steel in swimming pools

In general stainless steel should not be used for any structural application in swimming pools and associated wet areas without very careful consideration of the grade used and the detailing of the proposed sections. Stainless Steel is susceptible to stress corrosion cracking in warm chlorine laden atmospheres. This can cause rapid strength loss and sudden failure in members. In this respect the user is recommended to consult 'Stainless Steel in Swimming Pools' issued by the Nickel Development Institute and other associated bodies (NiDI publication no. 12 010). It should also be noted that stainless steel exposed to a chlorine environment will stain with rust quickly if not cleaned on a daily basis. (Note that stainless steel is often used in structural situations where the Structural Engineer would not normally be consulted, e.g. suspension rods for mechanical services, ceiling suspension systems, glazing brackets, wall ties / restraints, etc. and similar considerations will apply.)

Suspended floor construction

With steel framed buildings it is now common to use composite decking to form suspended concrete floors. The decking should be designed to meet the loading requirements specified but where the suspended slab spans over wet areas or filtration plant rooms the composite deck must be used as a sacrificial shutter and the concrete slab designed to act as a stand-alone slab in the event that the composite decking suffers corrosion in the longer term. In all cases the top flange of the steelwork must be painted.

Where composite decking is used as a sacrificial shutter, the designer may wish to take advantage of composite action for the design main floor steelwork support beams. In this case, studs should be pre-welded to the top flange of the floor beam and paint protected prior to the placement of the metal deck.

Roof construction

In non-wet areas the choice of roof construction and build up is traditional. In the pool hall and other wet areas the choice of roof build up will be by the Architect, but perforated aluminium is often chosen as the inner sheet to meet the requirements of durability and sound. For durability, the roof sheet is supported by hot rolled purlins that are painted with the same specification as the rest of the pool hall environment hot rolled steelwork (toes pointing down the roof slope if PFC's are used). The arrangement of the main roof beams and the grid arrangement will need to be considered to accommodate air handling distribution ductwork and the pool hall lighting.

Galvanised steel structural deck is not recommended for a pool hall environment unless additional paint protection is provided to both sides of the sheet.

Below ground drainage

Detailed discussions will be required with the local Water Authority, the Environment Agency (or SEPA), local drainage boards and Building Control to establish the constraints for the drainage design.

Surface water drainage

The main issues with the surface water drainage design will be common with those for any large building, that is, the volume of flow associated with:

- Car park drainage with interceptors
- Implementing SUDs
- Roof drainage.

Some of this can be offset by using rainwater harvesting to service non-critical elements such as toilets and urinals, although this can sometimes be of insufficient reliability and expensive to incorporate.

If soakaways are used to dissipate surface water flows consideration must be given to future groundwater levels and how this might affect the potential for floatation of the underground tanks.

Foul drainage

With regard to the foul drainage, the most common problem to be overcome is the rate of discharge from the filtration backwash. This needs to be established at an early stage in the design.

The rate of backwash is such that it is common to provide on-site storage with a holding tank. The back wash flows are then discharged back into the foul drainage network at an agreed flow rate.

Backwash discharge usually requires a Trade Effluent Discharge license. This would normally be discussed with the drainage Water Authority at design stage but the license would be applied for by the main contractor just prior to completion of the development.

Design standards and design loads

As with any other building, the designer should consider all relevant Eurocodes, National Annexes, British Standards and good practice guides in the design of swimming pool buildings.

Of particular importance are the following Euro Codes that are intended to replace BS8007:1987.

BS EN 1992-3:2006 Eurocode 2. Design of concrete structures. Liquid retaining and containing structures.

NA to BS EN 1992-3:2006 (National Annex).

Appendix 7: Building Services

Key affordable assumptions

(within the indicative design and costings)

Pool halls (main and secondary)

HVAC

- Heating via a dedicated ventilation system
- Mixing air circulation for pool (ductwork at high level designed for modulation)
- Dehumidification via fresh air
- Plate heat exchanger.

Lighting

- Corrosion resistant IP65+
- Metal Halide floodlights
- Up and down lighting.

Changing rooms

HVAC

- Heating via a dedicated ventilation system
- Plate heat exchanger
- Openable high level windows for natural ventilation in summer where possible.

Lighting

- Corrosion resistant IP65+
- LED * bulkhead fittings or high efficiency fluorescent fittings.

Fitness suite and studios

HVAC

- Heating and cooling provided via dedicated ventilation system
- Comfort cooling provided by chilled waer or VRF system.

Lighting

- Recessed modular LED or high efficiency fluorescent fittings.

Sports hall

HVAC

- Gas fired radiant heating (LTHW radiant panels should be considered if a suitable low / zero carbon heat source is incorporated)
- Natural ventilation via louvred vents at low level and exhaust stacks in roof (with insulated modulation dampers).

Lighting

- High efficiency fluorescent impact resistant fittings.

Café, offices, staff room and circulation

HVAC

- LTHW radiators
- Natural ventilation via manual openable windows where possible, mechanical ventilation for internal spaces.

Lighting

- LED recessed downlighters or high efficiency fluorescent fittings.

General

This section builds on previous Sport England guidance and highlights the most important aspects in relation to 25m affordable pool facilities. The assumptions set out in the Sport England's Affordable Community Swimming Pools (ACSP), Affordable Sport Centres (ASC) and Affordable Swimming Pools guidance will generally apply .

As with the Energy and Sustainability section of this review, the Building Services section also has a strong emphasis on energy saving option. Where requirements differ across the four design options, respective indicative values have been provided. For main plant area locations see the indicative layouts in Appendix 3.

Access and maintenance

Early consideration should be given to the way the building is maintained and CDM issues specific to each scheme must be recorded on a risk register. Examples of key aspects concerning access for maintenance and replacement within a sports centre development including a swimming pool include:

- Large items of plant in ground floor or basement plant rooms, e.g. filters, pumps, boilers, etc.
- Roof top plant, e.g. fans, motors, filters, chillers and AHUs
- Plant spaces serving moveable booms and floors
- Light fittings suspended at high level in pool and sports hall (avoiding suspended over pool as far as possible)
- Soffit suspended items, e.g. water polo curtains

Servicing routes between plant rooms and spaces need to be sized and designed for ease of installation and maintenance.

A services undercroft has not been included within the affordable scheme in the name of space efficiency and cost. Safe access requirements are, however, achieved on the following basis:

Water treatment at ground floor with a sump well in the plantroom to keep circulation pumps below the water level.

Majority of heavy plant and incoming services easily accessible on the ground floor

Air handling and heat rejection plant on plant 'decks' or on the roof accessible for crane access and day to day personnel access by stair.

Packaged rooftop plant rooms

Packaged rooftop plant rooms are an alternative option to an internal boiler room, and could be applicable to all four options as there is a large roof area available. This can provide reductions in the internal plant room area, installation time and programme sequencing for Contractors. However, the following issues need to be considered:

- Potential higher capital costs
- M&E and BMS procurement much earlier in the programme
- Impact on visual appearance of the roof
- Impacts on cranning, as they will often be the heaviest single item

Packaged plant rooms are not appropriate for water treatment plant as the pumps need to be located below the pool level to operate under flooded suction and the filtration plant is too large and heavy. The affordable scheme is based on a traditional plant room approach with water treatment, boilers and wet services in an internal plant room (ground floor and basement) and air handling plant on the roof, as currently indicated on Architects layouts.

Statutory supplies and services provision

Statutory authority and existing utility services information needs to be obtained for each site. Any existing services within the building footprint will need to be removed or diverted, and new supplies arrange in liaison with the utilities.

Below are outline supply sizes for preliminary cost estimates, however final sizing calculations must be undertaken by the team as part of the design process.

Electrical supplies

A suitable incoming three phase electricity supply will be required for the development. Outline estimates of supply size:

Option A	250 kVA
Option B	250 kVA
Option C	300 kVA
Option D	350 kVA

Gas supplies

A suitable incoming natural gas service will be required for the development. Outline estimates of supply size:

Option A	1400 kW
Option B	1600 kW
Option C	1800 kW
Option D	2000 kW

Water services

A suitable incoming water service will be required for the development. Outline estimates of supply size:

Option A	6 l/s
Option B	7 l/s
Option C	9 l/s
Option D	10 l/s

This estimate is on the basis of no cold water storage provision. Requirements for resilience are to be discussed with the commissioning body.

Telecommunications

The design team is to ascertain the requirements for telephone lines, internet connection and cable TV requirements with the commissioning body in order to allow suitable duct provision.

Design criteria

Any specific requirements in relation to design criteria should be discussed between the commissioning body and the design team.

External design criteria

Please refer to CIBSE Guide A for the following external design criteria (dry bulb and wet bulb temperatures) appropriate to the location of the development:

- Winter:
For calculating heating loads
For sizing of protective devices (such as trace heating and frost coils)
- Summer:
For calculating cooling loads
For sizing heat rejection plant

If the development is significantly above sea level then an adjustment needs to be made to winter design criteria.

Internal design criteria

Below is a discussion of design criteria specific to pools, please refer to the CIBSE A guide for guidance on support spaces (offices, café, etc.) and the Affordable Sports Halls (ASH) and Affordable Sports Centres (ASC) documents.

Pool water

Pool water temperature needs to be set and varied according to the prevalent type of use. Energy consumption increases with pool water temperature, so the temperature should be minimised with a balanced view on user satisfaction and comfort.

Changing the pool temperature takes a significant amount of time and energy. The heat load for the pool is generally sized on the basis of raising the pool water temperature by 0.5oC/hour, although the requirements for different temperatures and the programme for use should be discussed between the commissioning body and design team.

Below is an excerpt from the Pool Water Treatment Advisory Group guidance for recommended maximum pool temperatures for different types of use appropriate to the affordable scheme:

Competitive swimming and diving, fitness swimming, training	28°C
Recreational, adult teaching, conventional main pools	
Leisure pools	30°C
Children's teaching	31 °C
Babies, young children, special needs	32°C

Refer to *Sport England's Swimming Pools Design Guidance Note Appendix 2, Servicing the Building*, page 6 for further recommendations.

Pool hall

The pool hall air temperature should be controlled to be up to 1oC higher than the pool water. This temperature will provide a balance between evaporation and heat loss from the pool. When the air temperature exceeds the pool temperature, there should be no sensible heat loss from the pool to the hall. However, the higher the air temperature, the more moisture it can hold and therefore the higher the rate of evaporation (latent heat transfer) from the pool.

The relative humidity should be controlled between the range of 50-70%. Above 70% there are higher risks of discomfort and condensation, and below 50% evaporation rates and associated energy consumption will increase.

Changing areas

Changing areas are normally maintained at a temperature roughly half way between that of the pool hall and the entrance area to provide a comfortable transition.

Ventilation

The design of the ventilation system serving the pool hall is required to:

- Control air temperature and relative humidity
- Control air quality; chemicals, contaminants and smells
- Control condensation
- Minimise drafts which could be uncomfortable

The ventilation system should be sized on the larger of 10 l/s/m² of wetted area (pool and surround) or 15 l/s/m² of pool area.

The volume of fresh air is generally varied to control the humidity levels, however in order to maintain suitable air quality it should not be reduced to less than 20%.

System specification

Specification of the ventilation system components must be appropriate for the high humidity, temperature and contaminant levels within the air. This should include as a minimum:

- All elements to be epoxy paint coated internally and externally
- Melinex lined acoustic attenuators
- Fans fitted with drain plugs
- Coils with prepainted fins
- All fasteners, bolts and nuts are stainless steel or specially protected
- Damper motors IP 66
- Powder coating the above elements is an alternative to epoxy paint

Air circulation options

There are two main air distribution options, each with their different merits:

Displacement ventilation

Introducing air at low level within the space at low velocity and exhausting air at high level, displacement ventilation works by using the benefit of the natural effect of stratification.

Advantages:-

- Facilitates simpler variability of air volume, to match load and save energy
- Provides fresh air direct to occupants
- Encourages vertical air movement, removing pollutants from the occupied zone
- Low velocity system reduces fan power

Disadvantages:

- Requires ductwork routes at low level beneath pool surround (more expensive)
- More complex details for grilles at low level

Mixing ventilation

A mixing system is based on supply and exhaust ductwork at high level with air introduced at higher velocities (often via nozzles.) Fabric ductwork can provide a lower cost and maintenance solution.

Advantages:

- All ductwork at high level, provides simpler services routes

Disadvantages:

- More complex ductwork configuration to achieve a system that can modulate ventilation rates whilst maintaining required throw from grilles
- Mixing the air reduces the ability to remove pollutants at source

Comfort for different users

The pool hall conditions are generally focussed on the comfort of the bathers / competitors rather than spectators. Improved comfort for spectators can be achieved by:

- An additional ventilation system directing fresh air directly to the seating area
- Open-able windows behind spectators providing an option to introduce some fresh air

Heat recovery options

A significant portion of the energy load of a swimming pool is used to heat the pool hall air supply. In order to control air quality and humidity large amounts of heated moist air are exhausted and fresh air introduced. Considerable scope therefore exists for the use of heat recovery in the ventilation systems, options are outlined below.

Plate heat exchanger

A plate heat exchanger utilises a series of parallel plates through which the supply and exhaust air is channelled, providing hygienic separation between the supply and exhaust air paths, and achieving efficiencies up to 75%.

Run-around coil heat exchanger

A run-around system consists of heating coils within the supply and exhaust ducts, linked via a pumped heat transfer fluid. They do not require the ductwork to be adjacent which improves flexibility, but have reduced efficiency at 50-60%.

Heat pump heat recovery

Air handling units (AHU) are available with integrated heat pumps, which use electricity to extract more heat from the exhaust air. These systems can also be utilised to replace conventional heat recovery where available space is constrained.

Thermal wheels are not appropriate for a pool hall ventilation system, due to carry-over of moisture, chemicals and contaminants. However they are appropriate for other mechanically ventilated spaces.

Dehumidification options

Fresh air

The volumes of fresh air required in order to manage air quality are often sufficient to manage the control of humidity in the space. This method is preferable however the following active dehumidification methods are available; they should be implemented in conjunction with 'free dehumidification' from the fresh air.

Desiccant dehumidification

A desiccant wheel within an AHU provides dehumidification of the supply air if required by the high internal and external humidity levels. It incurs

comparatively small electrical load in rotating the wheel, and utilises heat to recharge the wheel. This technology can work well in conjunction with a CHP system due to the year-round availability of high-grade heat.

Heat pump dehumidification

Dehumidification can be achieved by utilising a heat pump to reduce supply air temperature (and remove the moisture) and rejecting this heat into the exhaust. This can utilise the same heat pump arrangement used for heat recovery in winter, operated in reverse.

Natural ventilation

Myth: Natural ventilation is not appropriate for pools

Fact: The use of natural ventilation to complement a mechanical system should be considered in all pools. Natural ventilation can provide the following benefits at warmer times of year:

- Fresh air can be directly introduced from outside to reduce fan power
- Cooler and dryer external air can provide improve comfort to clothed spectators/ staff
- Open windows can provide a pleasant environment

Natural ventilation openings and controls need to be carefully designed in order to minimise the risk of draughts for bathers, and to integrate with the mechanical ventilation controls or the centre management regime (if manually open-able.)

Natural ventilation is applicable to all other occupied spaces subject to acoustic constraints; sports hall, fitness suite, activity studios, offices and café.

Changing rooms

Changing rooms are often designed to be part of the main pool air volume (in order to achieve economies in levels of supervision staff) and therefore conditioned to a similar temperature. This can lead to an uncomfortably hot and humid environment. The affordable design separates the

changing village from the hall, so an additional ventilation system will blend of air from the pool hall (to make use of the heat) with fresh air to improve comfort.

Heating

The swimming pool water, pool hall are unusual in that they require heating for most of the year.

Heat recovery options

A significant portion of the energy load of a swimming pool is used to heat the pool water. This is to make up for latent heat loss via evaporation, and addition of water to make-up for backwashing filters and dilution. Domestic hot water consumption is also high to support both wet and dry side changing facilities. Considerable scope therefore exists for the use of heat recovery in the pool systems.

Heat rejection from chiller

Where a fitness suite is incorporated into the development comfort cooling will often be required. The heat rejected from this cooling system can be injected into the pool by utilising a water cooled chiller or WRF (water refrigerant flow) system.

Heat rejection from pool water

Guidance denotes that 30 litres of pool water should be replaced per bather to control Total Dissolved Solids (TDS.) This water can be passed through a heat exchanger and used to pre-heat the make-up water. The use of heat recovery from backwash water is not recommended. Backwash water generally contains large quantities of contaminants which can lead to biofilm build up in pipework, and blockages in pumps and heat exchangers.

Heating methods

Warm air heating

Warm air heating is a good method to heat the pool hall and changing rooms, as the ventilation system is already required to control the conditions of the space.

Underfloor heating

Myth: Underfloor heating is always the best solution for a pool surround and changing area.

Fact: Changing rooms in a modern building will have relatively small heat losses with respect to their gains. They normally operate on a design criteria of 26-28°C which matches the normal maximum floor temperature of an underfloor heating system. So the ability for the floor to transfer heat into the space is minimal and the system can in reality rarely be used.

If the changing space is separate from the pool hall and lower space temperatures (25°C) are acceptable, then underfloor heating could be used to dry the floor and provide some additional comfort. Although the significant investment needs to be balanced against the level of benefit.

Gas radiant heating

In line with the Affordable Sports Hall guidance document; gas radiant heating is advised for the sports hall. This provides a quick response system and removes the risk of leaks.

Domestic services

Domestic cold water storage is included within the affordable scheme plant room space allocation. However the design team should consult with the commissioning body over the level of resilience required to determine the final size of water storage for the scheme.

The carbon emissions associated with domestic hot water generation can be reduced by incorporating a solar thermal system (please refer to Appendix 8 or by utilising heat recovery from pool water or cooling to other spaces.

Lighting

Please refer to CIBSE lighting Guide 4: Sports Lighting (2006) and Sport England Artificial Sports Lighting Guidance (2012.) This section does not attempt to repeat information found in other guidance documents, but highlight the most crucial aspects in relation to an affordable pool.

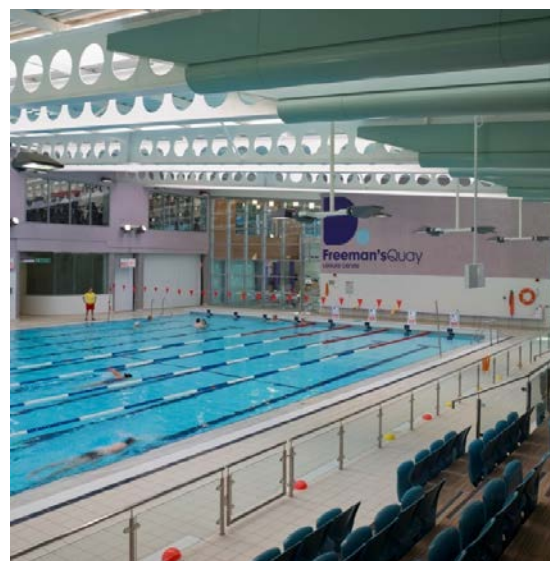
General

The luminaires to be low wattage high efficient light sources taking into consideration colour rendering, lamp life and energy efficiency. All luminaires to be selected to be suitable for aggressive environments as well as IP55 rated as a minimum. LED fittings can provide benefits in relation to significantly reduced energy consumption and longer lamp life. They will incur a larger capital costs, however they will provide better value over the lifetime of the building and generally pay back in less than 10 years.

Managing reflections and glare

The lighting design of a pool is a complex challenge; it will require a compromise between the following interconnected considerations:

- The design should aim to direct light into the pool tank in order to provide a clear view of bathers to spectators and lifeguarding staff
- Angles of attack of fittings should aim to be $>50^\circ$ from horizontal; this will minimise the direct glare from fittings to bathers and reflections off the water obscuring the view for lifeguards and spectators
- Turbulent water changes the angle of the surface in relation to the fittings and viewer, and therefore in some instances a higher threshold than 50° should be considered
- Light fittings should ideally be located above the pool surrounds and not above the pool tank for ease of maintenance
- Indirect and diffuse light sources can reduce transmission of light into the pool tank and produce reflections
- Underwater lighting can help reduce the risk of reflective glare, the additional cost must be balanced against their benefit (it is not part of the affordable scheme)



Lighting larger pools

In wider swimming pools (8 lanes or more) achieving the 50o rule without locating fittings over the pool is often unachievable, so the following alternative solutions should be assessed by the team in relation to the specific drivers for the project, the pool uses and the maintenance strategy:

- Access to fittings provided by a roof gantry
- Access to fittings provided by a pulley system

Acoustics

Advice should be sought from an acoustic consultant with respect to the performance of a pool hall. For the comfort of all swimmers, coaches, lifeguards and spectators, the ability to hear audible fire alarms, public address and evacuation calls, and for speech intelligibility during lessons and coaching. This is particularly important in the larger hall volume associated with 8 lane options.

Pool and sports halls which are to be used by local schools for teaching are to comply with the requirements of Building Bulletin 93.

Internal NR ratings

External noise should be assessed via an acoustic survey and appropriate criteria set to control noise from mechanical plant. These should be agreed with the local authority.

The internal noise criteria and background noise levels generated by building services and external noise ingress for various areas to be in accordance with the CIBSE recommendations:

- Swimming pool: NR 40-50
- Changing areas: NR 35-45
- Office areas: NR 35
- Health & fitness: NR40
- Sports hall: NR40

Reverberation times

The pool hall construction and finishes should provide control of the reverberation time (RT) to between 1.5 and 2.0 seconds at 500Hz. Particular consideration should be given to reverberation times at lower frequencies, if the use of music or PA systems is a key part of the functionality.

Privacy and noise insulation

Consideration should be given to privacy and noise insulation between the following spaces:

- Group changing, for competing teams
- First aid / physiotherapy room
- Male / female WCs
- Offices

Electrical services

General power

The use of rechargeable equipment to clean poolside and changing areas should be considered to avoid the need for 110 volt distribution and outlets throughout wet areas. Suitable charging points would be required in cleaning and pool stores.

Public address

The public address (PA) system should be audible in all areas of the development. The PA system is required for a number of purposes:

- As an essential part of the emergency procedures
- To communicate with spectators to relay entertainment
- To convey messages from sponsors and advertisers

Refer to relevant sections of 'Guide to Safety at Sports Grounds,' Department for Culture, Media and Sport (2008), for further information.

Pool timing equipment

The requirements for pool timing equipment, in relation to any competition use, should be discussed with the commissioning body during the briefing process. Suitable containment routes will be required for pool timing equipment, including touch pads, shot clocks, scoreboard and input from poolside laptops. The scoreboard may be required to integrate with any site-wide digital signage system.

Poolside alarms

Each lifeguard position should be provided with an independent alarm system, remotely monitored at the reception area.

Supplementary bonding

Supplementary equipotential bonding the pool tank and associated wet areas requires careful consideration with specialist input during the design development. Supplementary bonding involves the interconnection of all simultaneous accessible conductive parts to the protective conductor system.

Specialist pool services

For specialist pool services guidance please refer to the existing Affordable Community Swimming Pool guidance and Swimming Pool Water Treatment and Quality Standards for Pools and Spas, Pool Water Treatment Advisory Group (PWTAG) 2009.

Both documents give a comprehensive description of water treatment options which are not repeated here. Below are some comments on newer approaches to water treatment which may help realise improved performance or reduction in energy consumption.

Regenerative media filtration

Regenerative media filters remove particles from dirty pool water by forcing the water through a thin layer of powdery filter media that captures the unwanted dirt, oils, and other nasty materials suspended in pool water.

The main two types of media are; diatomaceous earth or perlite. Diatomaceous earth (DE) is a fossilized material that is mined and refined for use as a filter medium, however is very harmful if inhaled and therefore imposes strict maintenance regimes. Perlite is derived from volcanic rock that is superheated to create the powdery substance, and is the latest recommended regenerative media.

Regenerative media filters have a higher capital cost and therefore are not part of the affordable scheme, although they should be considered on the basis of the following potential benefits:

- Filtration of particles from pool water down to the 1 to 5 micron range (compared to around 20 microns for sand filters)
- Removal of many microorganisms (NB not a replacement for UV treatment)
- Potential for reduced plant footprint
- Potential for reduced backwash volume; however it should be noted that backwash volumes contribute to an overall requirement for pool dilution to control total dissolved solids (TDS) so the water and energy savings are not always able to be realised.*

*The dilution volumes should be maintained at 30 litres / bather, but can be reduced if a reverse osmosis system is installed, however this will incur higher capital and running costs.

This technology is still reasonably new, but overall can offer good benefits in relation to water quality. However, these benefits need to be balanced against the higher capital costs and higher running costs associated with regular media replacement.

Modulation of water treatment systems

Circulation pumps on all new water treatment systems should be fitted with variable speed drives (VSDs.) This, alongside appropriate controls, will enable the system to vary the volume of water circulated through the water treatment system against the bathing load (number of occupants.) This modulation can realise the following benefits;

- Reduced pumping energy
- Reduced heat loss from circulatory system
- Reduced energy associated with UV treatment (where incorporated)

Appendix 8: Energy and Sustainability

This summary contains information on the energy and sustainability aspects of the indicative affordable design, including the requirements associated with compliance with Part L2A 2013 of the Building Regulations. The Appendix provides further details on these systems and alternatives. Please refer to Appendix 7 and associated summary for information on building services engineering.

Please note that Local Authority requirements for energy efficiency and renewable energy generation may exceed those outlined below and a dynamic simulation for each project should be carried out to verify compliance with Part L2A. Technology selections will vary from project to project and should be appraised by the design team in order that they are appropriate to the building form and function and align with the priorities of the commissioning body.

Key affordable assumptions (within the indicative design and costings)

Energy conservation measures

- Air handling units with heat recovery
- Modulation of the fresh air provided by the ventilation system to meet varying loads in all occupied spaces
- Variable speed drives on all pumps, both for heating, domestic services and water treatment
- Sizing of ductwork to achieve low specific fan power
- Daylight linked dimming control on lighting in all well daylight areas
- Lighting control based on presence or absence detection (as appropriate) in all ancillary rooms and stores.

Renewable technologies

- Solar thermal collectors (100m² array).

Water conservation: sanitaryware specification to include:

- Sensor or percussion taps and showers
- Dual flush WC's
- Water efficient shower heads
- Flow regulators to taps

Metering and monitoring

- Meter 90% of annual energy consumption by use (Part L2 requirement)
- Output from any renewable energy generation (Part L2 requirement)
- Heat meter on LTHW branch serving pool water heating
- Temperature and RH sensors in the pool hall at pool level and in spectators seating
- Visitors numbers monitored via tills.

General

This section builds on previous Sport England guidance and highlights the most important aspects in relation to 25m affordable pool facilities. The assumptions set out in the Sport England's *Affordable Community Swimming Pools (ACSP)*, *Affordable Sport Centres (ASC)* and *Affordable Swimming Pools* guidance will generally apply. Under the Climate Change Act 2008, the Government put in place legally binding carbon reduction targets of 35% by 2020 and 80% by 2050 compared to 1990 levels.

The construction and operation of UK buildings accounts for approximately 60% of national carbon dioxide emissions. Swimming pools are inherently high consumers of energy, with CO₂ emissions circa 4 times that of typical schools and twice that of typical office buildings. There is therefore scope to seek a lot of benefit from energy efficiency measures and renewable technologies. Therefore, this review has a strong emphasis on energy saving options which is particularly important for sports centres incorporating a swimming pool.

Local planning guidance

The relevant Local Authority Core Strategy or equivalent document will differ from one authority to another and should be referred to as part of the overall energy assessment for the site. The Core Strategy document will outline requirements for energy efficiency, renewable energy generation and sustainable urban drainage solutions.

Building Regulations Part L2A

The building should be designed in compliance with the Part L of the building regulations for the conservation of fuel and power in non-domestic buildings. The 2013 version of this document came into force for all buildings that did not have a Building Control application lodged or started on site on 6 April 2014.

The Affordable scheme has been designed to comply with, but not exceed, the requirements of Part L of the Building Regulations. The approach adopted is one of 'fabric first' as this provides the best carbon reduction for the investment.

Use of efficient M&E services such as heat recovery and LED lighting has been included as far as this is reasonable within the budget.

In addition to this, an array of solar thermal panels has been included in order to meet some of the large domestic hot water load. For more information see later section.

A dynamic simulation of option D has been carried out in order to verify compliance and the results have informed the fabric performance, selection of energy efficiency measures and renewable technologies. However, design teams need to carry out their own Part L calculations based on the specific form, fabric and systems for each individual project.

Design hierarchy

The design approach for swimming pools should be focussed on making energy savings in the most cost effective and efficient manner. In order to achieve this, 'passive' measures (such as improvements to the form and fabric) should be applied first before considering 'active' methods (such as renewable technologies.)

Fabric performance

Thermal transmittance

Part L of the Building Regulations provides two sets of thermal transmittance (U-value) for building elements.

- 'Limiting' values; minimum allowable performance for any element
- 'Notional building' values; benchmark values better than the 'limiting' values and comparable to a typical regulation compliant building

A large proportion of energy consumption in pools relates to heating the water in the pool and air in the pool hall. The temperature is generally much higher internally than externally in the UK climate therefore to an even greater extent than other buildings a good fabric performance must be the first consideration with respect to reducing carbon emissions.

Below is a summary table indicating the Part L 2013 'limiting U-values,' 'notional' building U-values and proposed target U-values for the affordable design. The targets U-values are approximately 20% better than the 'notional' building, with some variation accounting for the relative costs and feasibility of different elements.

Element	Limiting U-values	Notional building U-values	Target U-values
	W/m ² K	W/m ² K	W/m ² K
Roof	0.25	0.18	0.1
Walls	0.35	0.26	0.2
Floor	0.25	0.22	0.18
Windows *	2.2	1.6	1.5
Roof lights	2.2	1.8	1.5
Pool tank	0.25	0.25	0.25
Internal glazing **	--	--	1.5
Internal walls **	--	--	0.2

* Curtain wall systems to fulfil the same criteria as windows, utilising warm-edge spacers

** Between pool hall and adjacent spaces

Recommended performance for internal glazing and walls between the pool hall and adjacent spaces is included in addition to the external envelope. This is because the pool hall is approximately 10-15°C higher than adjacent spaces, which is comparable in temperature difference to an average winter external to internal scenario.

Air tightness

Careful detailing to achieve a high level of air tightness is crucial, both externally and between internal spaces with different design criteria. The 'notional' building criteria under Part L2013 achieves 3 m³/h/m² at 50Pa. This should be the minimum target for any new pool development.

Air testing of the external envelope is required for building regulations compliance. In addition to this as part of the Contractors responsibilities internal partitions between the pool hall and adjacent spaces should be tested under the same criteria, due to the energy consumption associated with air leakage. Also carryover of air from the pool hall to adjacent spaces can cause issues with corrosion.

Condensation

The environment in a pool hall is hot and humid year round, with humidity control most difficult in summer. The design team needs to carefully manage the risk of condensation with attention to:

- Construction details; removing cold bridges and sources of air leakage
- External glazing performance and air movement over glazing

- Performance of internal glazed partitions (particularly between the pool hall and fitness suite)
- Avoiding internal rainwater pipework
- Design of cavity wall and vapour barriers to minimise risk of interstitial condensation

Design for daylight

Natural light can make an important contribution to sustainability by reducing the electrical energy used for artificial lighting and by providing passive solar heating. It also contributes to the well-being of visitors and staff, as well as aesthetics and feel of the space.

Location of glazing and glare

Glazing on the perimeter via windows or curtain walling systems can provide pleasant views out for users and views in to advertise the centre. However, appropriate orientation and placement of glazing is necessary to avoid the risk of glare to lifeguards. Building orientation and adjacencies can result in a compromise and elevations with south and west facing glazing may be unavoidable. In this case, shading devices such as external louvres and overhangs or internal light shelves and baffles, can be used to manage glare and diffuse direct sunlight. Solar glass may also be required.

Openable windows behind spectator seating can provide natural ventilation in summer, making the space more comfortable without requiring additional air handling plant.

Rooflights have a lower risk of glare as water is less reflective of light the larger the angle from the surface. They also provide the additional benefits of passive solar gain to the pool and a potential exhaust air path for natural ventilation in summer. Providing approximately 20% of the pool hall area in roof glazing will generally enable the above benefits to exceed the additional heat loss.

Translucent insulated panel systems can provide natural light with less heat loss than conventional glazing. However, the properties of the panel reduce the light transmission and solar gain through it, which can outweigh the benefit of the improved U-value.



Minimising energy consumption

Swimming pools and energy consumption

The unique warm and humid environment of a swimming pool hall is inherently energy intensive. The energy flow within a pool hall is dominated by the evaporation of water from the pool and ventilation to control the internal humidity levels. Close control of the pool hall environment is essential to control energy use.

Essential energy saving techniques

The following is a list of energy saving techniques which are deemed to be essential to the affordable pool design and are included within the cost plan. They are included either for compliance with Part L of the Building Regulations, or on the basis that the additional capital cost incurred would 'payback' via reduced operating costs over a relatively short period of time. Please refer to the Building Services section for further information on each.

- Heat recovery in air handling units
- Modulation of the fresh air provided by the ventilation system
- Variable speed drives on all pumps, both for heating, domestic services and water treatment
- Use of high efficiency light fittings

- Specification of pool covers which are easy to use
- Sizing of ductwork for low specific fan powers
- Insulating pipework which circulates water between plant room and the pool
- Lighting controls based on presence or absence detection (as appropriate) in all ancillary rooms and stores
- Daylight linked dimming on lighting in well daylight spaces

Metering strategy

By providing meters and submeters on energy consuming plant and areas, the building operators are provided with information to enable them to manage the use of the spaces and minimise energy consumption. We advise that the affordable 25m pool scheme incorporates BMS linked meters to enable:

- > 90% of the annual energy consumption by use (requirement of Part L)
- Output from any renewable energy generation (requirement of Part L)
- A heat meter on LTHW branch serving pool water heating

The following sub-meters are also recommended:

- Heat meter on LTHW branch serving LTHW coil(s) in main AHU(s) serving the pool hall
- Electricity meter on power supply to water treatment plant
- Electricity meter on power supply to cooling plans
- Water meter on supply for pool top-up

Metering data should be logged automatically by the BMS, incorporating a simple user interface to allow the building manager to view and export the data.

Renewable energy options

Renewable technologies must be assessed in relation to the inherent energy demands of the building, the constraints of the site, the local authority planning requirements and the aspirations of the commissioning body. Depending on the overall design and use of the development, some renewable technologies are likely to be required to comply with Part L2013. Options for renewable technologies which can be suitable for pool and leisure centres include:

Solar thermal collectors

A solar thermal collector is a panel which absorbs the sun's radiation and uses it to heat water, which is circulated from the panel into a storage cylinder. There are two main types; flat panel and evacuated tubes, the latter being the more efficient but more expensive option.

Advantages:

- Comparatively low maintenance
- Relatively low visual impact
- Provide a visual amenity which can be used for education in sustainability issues
- More cost effective (£/kg CO₂ saved) than solar PV
- Renewable Heat Incentive (RHI) funding available currently
- Suits pool applications as the pool can be used as a heat sink, which reduces risk of overheating panels
- Low noise

Disadvantages:

- Requires a large area of accessible flat roof, or south facing pitched roof (provided on all the model designs.)

Combined heat and power (CHP)

Combined heat and power is the generation of electricity by either an engine or turbine and the recovery of the by-product, heat. Most often it is based on a natural gas fuel although biofuels can be considered. CHP can provide a low carbon option with respect to grid supplies due to the recovered heat and minimal transmission losses.

Care should be taken not to oversize CHP systems. They should be sized to meet the base (minimum) heat load, which must be carefully considered especially where heat recovery and solar gain design approaches are implemented.

Advantages:

- Suits pool applications as there is an available year-round heat sink which increases run-time and financial benefit
- Low visual impact, as normally housed in plant room
- If correctly sized can provide a cost effective carbon reduction method

Disadvantages:

- Can encourage behaviour which increases heat consumption
- Can be noisy, although this can normally be managed by locating within a plant room

- Can incur relatively higher maintenance cost, especially if FM staff are not familiar with the technology
- Gas fired CHP does not reduce reliance on fossil fuels as part of improving supply resilience

Solar photovoltaic (PV)

A solar photovoltaic panel utilises semi-conductors to generate electricity from the sun's radiation.

Advantages:

- Comparatively low maintenance
- Relatively low visual impact
- Provide a visual amenity which can be used for education in sustainability issues
- Incentives such as Feed-In-Tariffs (FIT) from the government can improve the financial payback, however please note tariffs are subject to review

Disadvantages:

- Comparatively expensive, with longer payback times
- Can involve high energy consumption in their manufacture and the use of unsustainable materials

Wind turbines

A wind turbine utilises energy from the wind to turn aerofoil blades, which generate electricity. The blades can either rotate horizontally or vertically.

Advantages:

- Large scale wind turbines can provide the best carbon offset for the capital invested of all renewable energy technologies
- Provide a visual amenity which can be used for education in sustainability issues
- Incentives such as Feed-In-Tariffs (FIT) from the government can improve the financial payback; however, please note tariffs are subject to review

Disadvantages:

- Within developed areas, noise and daylight flicker from the turbines can cause a disturbance
- Within urban areas turbulent air flow can significantly reduce turbine output
- Within public areas, ice shedding under certain weather conditions must be considered

Water conservation

Water consumption within leisure centres is significant for showers, WCs, catering and pool water top-up. The utility costs associated with the water supply are generally more modest than those for gas or electricity, leading to longer payback periods for water saving technologies. However the following measures can be considered:

Rainwater recycling

Rainwater can be collected from rainwater pipes and directed into a below ground storage tank. The following methods should be considered to improve the quality of the water:

- Leaf filtration
- Use of the below ground tank to allow sediment to collect (tank to be accessible for cleaning)
- Floating suction filter to collect water from the clean portion of the tank

With the above filtration rainwater can be successfully used to backwash the pool filters and for irrigation of any pitches and soft landscaping.

If rainwater is to be used for WC flushing or pool top-up, then further consideration is required into expectations for visual appearance and risks to the public. UV filtration can be used to improve water quality, but the benefits should be weighed against the additional energy consumption and maintenance.

Greywater recycling

For every bather, 30 litres of water is recommended to be replaced from the pool, in order to control Total Dissolved Solids (TDS.) This water can be collected and recycled for WC flushing. The recycled pool water should not be stored for long periods of time (due to its elevated temperatures) and therefore break-tank sizes should be minimised.

Myth: Backwash water is useful and should be recycled.

Fact: Backwash water is used to flush through and clean the pool filters, so is generally not sufficiently clean to be re-used (even for WC flushing) without significant levels of water treatment, that would generally outweigh any benefit.

Sanitaryware

The following sanitaryware items are included as part of the affordable scheme to reduce water consumption:

- Sensor or percussion taps, urinals and showers with timed flow
- Dual flush WCs
- Water efficient shower heads
- Flow regulators to taps

BREEAM

The BREEAM assessment method can help to raise the sustainability standards across a broad range of areas. From 30th June 2014 new pools will be assessed under the New Construction Non-Domestic 2014 assessment criteria. See the BRE published manual for full details of the assessment criteria. A summary of some items of note in relation to BREEAM assessments in sports centres and pools is set out below.

Ene 01 Reduction of emissions

Aim: to recognise and encourage buildings designed to minimise operational energy demand, consumption and CO2 emissions.

As pools have inherently high energy consumption, methods (as outlined above) to reduce consumption will result in larger potential % offsets achievable in comparison to other building types.

Ene 08 Energy efficient equipment

Aim: to recognise and encourage procurement of energy-efficient equipment to ensure optimum performance and energy savings in operation.

Credits are available where automatic or semi-automatic covers are fitted to all pools. The affordable scheme includes pool covers and moveable floors which can be utilised as a cover.

Wat 02 Water monitoring

Aim: to ensure water consumption can be monitored and managed and therefore encourage reductions in water consumption.

Credits are available for a BMS linked water meter on the mains water supply and sub-meters to areas consuming >10% of the building's total water demand. This would normally apply to both the pool top-up and the showers.

Ene 02 Energy monitoring

Aim: to recognise and encourage the installation of energy sub-metering that facilitates the monitoring of operational energy consumption.

Additional credits are available for BMS linked sub-meters for major energy consuming areas serving the pool and change areas.

Soft Landings and monitoring

Soft Landings is a collaborative approach to delivering buildings that meet occupants' needs and allow the performance of the building to be optimised. Commissioning bodies and design teams should collectively review the opportunities for a soft landings approach, in order to aim for a smooth handover and to give a building that operates as designed.

To aid the Soft Landings approach; in addition to the metering discussed above the building management system should enable the following monitoring and logging of:

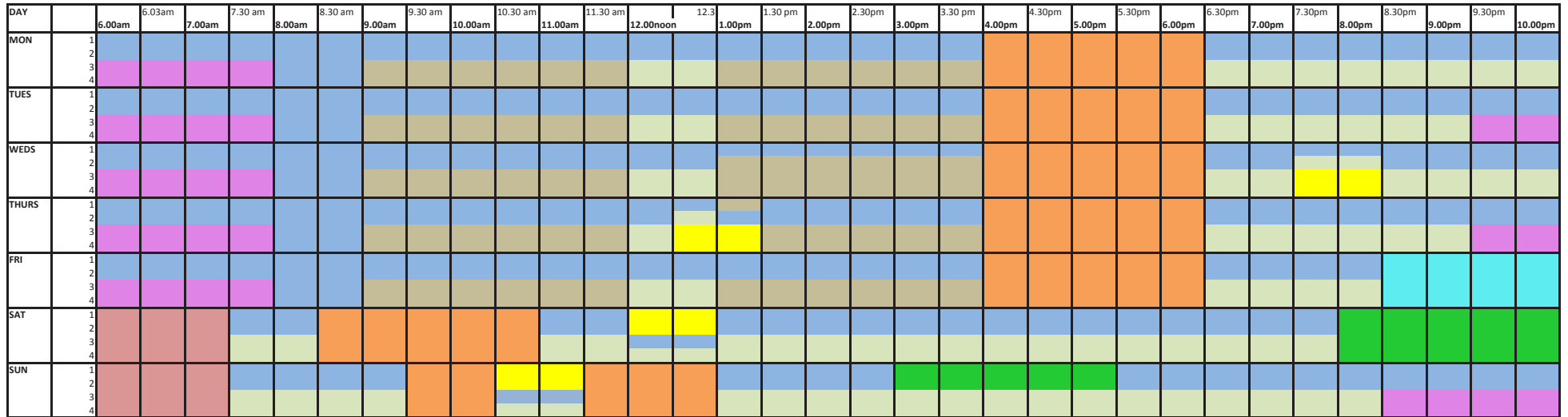
- Temperature and RH in the pool hall at pool level and in spectators seating
- Visitor numbers

For more information refer to the Soft Landings Framework, BSRIA BG 4/2009 document which outlines how to implement Soft Landings on your scheme.

Appendix 9: Programmes of use for 25 m swimming pools and secondary pool

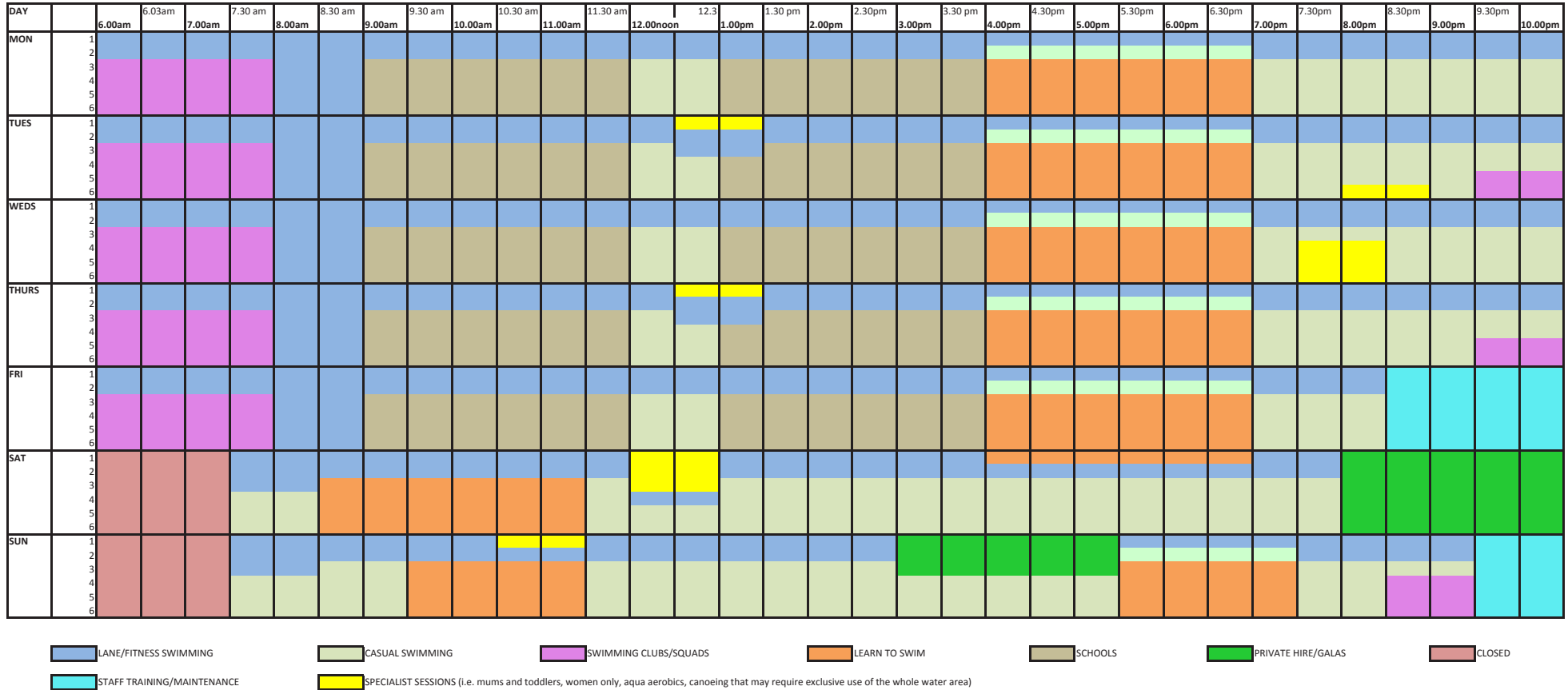
Option A: main pool, 4 lanes

Option A - 4 lane pool, term time (39 weeks)



Option B: main pool, 6 lanes

Option B: 6 lane pool term time (39 weeks)



Option C: main pool, 6 lanes

Option C: 6 lane pool term time (39 weeks)

DAY		6.00am	6.03am	7.00am	7.30 am	8.00am	8.30 am	9.00am	9.30 am	10.00am	10.30 am	11.00am	11.30 am	12.00noon	12.3	1.00pm	1.30 pm	2.00pm	2.30pm	3.00pm	3.30 pm	4.00pm	4.30pm	5.00pm	5.30pm	6.00pm	6.30pm	7.00pm	7.30pm	8.00pm	8.30pm	9.00pm	9.30pm	10.00pm			
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- LANE/FITNESS SWIMMING
- CASUAL SWIMMING
- SWIMMING CLUBS/SQUADS
- LEARN TO SWIM
- SCHOOLS
- PRIVATE HIRE/GALAS
- CLOSED
- STAFF TRAINING/MAINTENANCE
- SPECIALIST SESSIONS (i.e. mums and toddlers, women only, aqua aerobics, canoeing that may require exclusive use of the whole water area)

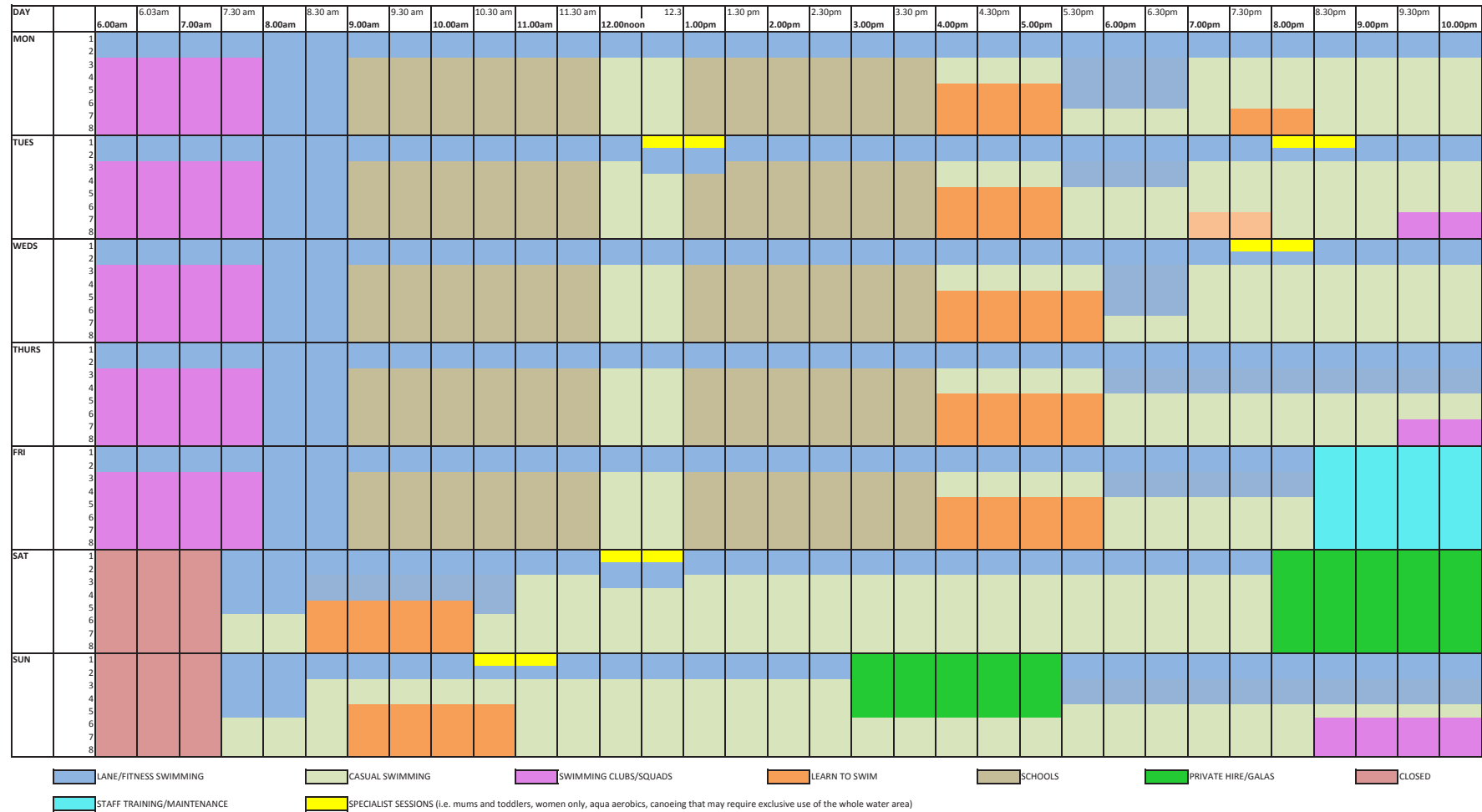
Secondary Pool Term Time

DAY		6.00am	6.03am	7.00am	7.30 am	8.00am	8.30 am	9.00am	9.30 am	10.00am	10.30 am	11.00am	11.30 am	12.00noon	12.3	1.00pm	1.30 pm	2.00pm	2.30pm	3.00pm	3.30 pm	4.00pm	4.30pm	5.00pm	5.30pm	6.00pm	6.30pm	7.00pm	7.30pm	8.00pm	8.30pm	9.00pm	9.30pm	10.00pm			
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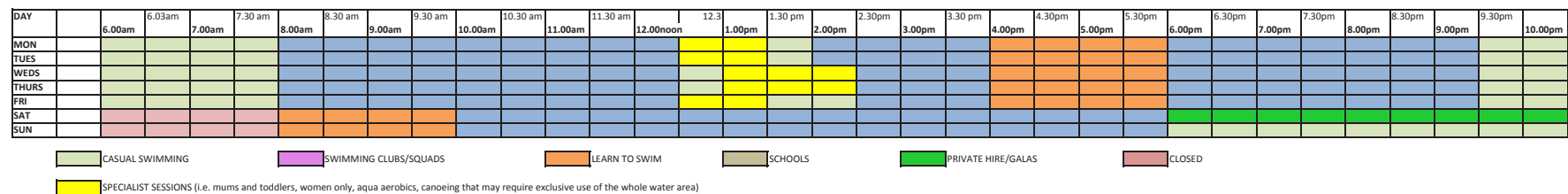
- CASUAL SWIMMING
- SWIMMING CLUBS/SQUADS
- LEARN TO SWIM
- SCHOOLS
- PRIVATE HIRE/GALAS
- CLOSED
- SPECIALIST SESSIONS (i.e. mums and toddlers, women only, aqua aerobics, canoeing that may require exclusive use of the whole water area)

Option D: main pool, 8 lanes, with learner pool

Option D: 8 lane pool option, plus secondary pool, term time (39 weeks)



Secondary Pool Term Time





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Before using this guidance for any specific projects all users should refer to the User Guide to understand when and how to use the guidance as well as understanding the limitations of use.

Click here for '**User Guide**'

Click here for '**Design and Cost Guidance**'

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Sport England

1st Floor, 21 Bloomsbury Street
London WC1B 3HF
Tel. +44(0)8458 508508



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