18/01/26

Oak Archaeology Wales

Desk-Based Assessment: Hydrological Infrastructure within the Ruperra Roman Military Complex and Associated Archaeological Potential

Introduction and Scope

This Desk-Based Assessment (DBA) examines the hydrological infrastructure associated with the spring-fed well, culverts, drains, bathhouses (A, B and C), perimeter wall, and associated exercise / swimming channel within the study area. The assessment is based on site observation, photographic evidence (Figures 1–34), topographic relationships, and visible structural remains, with particular emphasis on water supply, drainage, and flood control systems.

The purpose of this DBA is to:

- Identify and describe hydrological features;
- Assess their function, interrelationship, and alignment with landscape topography;
- Evaluate archaeological potential and significance;
- Provide a structured evidence base for further archaeological consideration.

2. Hydrological Overview

The site is centred on a spring-fed well system supplying clean water via engineered culverts to multiple bathhouses and a large exercise / swimming channel, while simultaneously managing surface and waste water through an extensive drainage network.

The system demonstrates:

- Deliberate alignment with natural topography rather than rigid axial planning;
- Segregation of clean spring water from waste drainage;
- Defensive and maintenance considerations (grilled sumps, boxed culverts);
- Long-distance hydraulic planning (c. 545 m water conveyance).

3. The Spring-Fed Well and Primary Supply Route

3.1 Well and Sump

The principal water source is a spring-fed well approximately 6 m in diameter, with a sump adjoined on the south-west axis (Figures 13–14). The sump appears integral to the well's operation, acting as a sediment trap and flow regulator prior to water entering the supply culvert.

Large and small stone accumulations around the well (Figures 21, 23) likely represent structural lining, collapse material, or deliberate consolidation.

3.2 Primary Culvert Alignment

From the south-east axis of the well, a boxed culvert approximately 1 m wide departs and runs south-east toward the amphitheatre area and bathhouse complex (Figures 1, 10, 22). The route follows the natural lie of the land, deliberately avoiding strict east–west alignment in order to maintain a level hydraulic gradient and prevent erosion or stagnation.

This design choice is particularly significant in relation to the drop-off forming the natural basin of the amphitheatre, indicating careful landscape-responsive engineering.

4. Bathhouse Supply and Drainage Systems

4.1 Bathhouse C (Amphitheatre)

Drainage pipes observed running south-east toward the amphitheatre road (Figures 15–16) likely serve Bathhouse C, located directly adjacent to the amphitheatre road. The pipes demonstrate a controlled, boxed system until passing the bathhouse, after which the waterway opens for standard drainage, reinforcing the prioritisation of clean spring water for bathing and drinking

4.2 Bathhouse B

Significant stone material is visible at the Bathhouse B location (Figures 19–21), suggesting robust construction and repeated phases of maintenance or rebuilding. The proximity of the spring-fed supply indicates Bathhouse B was a primary consumer of clean water within the system.

4.3 Bathhouse A

Bathhouse A lies toward the south-west end of the system, close to the outlet waterway. Its position suggests it functioned downstream within the broader hydrological network, receiving managed flows after upstream distribution.

4.4 Bathhouse A (South-Western Terminal Bathhouse)

Bathhouse A is located at the south-western extent of the hydrological system, close to the outlet waterway and terminal drainage zone, and forms a critical component of the overall water-management strategy.

Unlike Bathhouses B and C, which are primarily supplied by upstream clean spring water, Bathhouse A occupies a downstream position within the network. This positioning strongly suggests a functional and hierarchical role within the bathing complex.

Evidence indicates that Bathhouse A:

- Received regulated spring-fed water via the same primary culvert system supplying Bathhouses B and C;
- Was positioned deliberately to take advantage of gravity-assisted flow following upstream bathing and exercise use;
- Acted as a final bathing, cooling, or cleansing stage, prior to water entering the main drainage and disposal system.

The proximity of Bathhouse A to:

the outlet waterway, the 545 m long engineered exercise / swimming channel, and the terminal drainage infrastructure, strongly suggests it formed the hydrological endpoint of the bathing sequence, where water could be reused before controlled discharge.

This downstream placement is consistent with Roman bathhouse planning principles, where water was frequently cascaded through multiple bath suites before final disposal.

Relationship Between Bathhouse A and the Exercise Channel

The exercise / swimming channel, measuring approximately 10–11 m in width and extending c. 545 m, terminates in close spatial and functional association with Bathhouse A.

The presence of:

the large dark oak timber beam (Figures 24–26), aligned precisely between the channel funnel mouth (NE) and the terminal zone near Bathhouse A (SW), strongly implies that Bathhouse A was directly involved in: flow regulation from the channel, water retention or slowing prior to drainage, or structural control of water volume during peak use.

This reinforces the interpretation of Bathhouse A as a key hydraulic control point, not merely a passive downstream recipient.

Integrated Bathhouse Hierarchy

The hydrological system should now be understood as a three-bathhouse complex, deliberately arranged along a managed water gradient:

Bathhouse C – amphitheatre-facing, clean-water priority, healing and ceremonial use

Bathhouse B – central bathhouse, heavy stone construction, primary bathing complex

Bathhouse A – downstream terminal bathhouse, water reuse, cooling, and controlled discharge

This sequence demonstrates intentional design, not accidental placement.

5. Drainage, Sumps and Defensive Water Control

5.1 Grilled Drain Sump and Culvert Terminal

A grilled drain sump with rounded culvert terminal is visible just outside the perimeter wall (Figures 4–5). This feature is located approximately 45 m from the centre of the perimeter wall, and its form suggests a deliberate defensive and maintenance function, preventing access beneath the wall while controlling water outflow.

The rounded culvert head on the south-west side likely represents a main drainage run, potentially connecting to further unseen drainage terminals.

5.2 Additional Culverts

A boxed culvert approximately 9 inches wide is visible nearby (Figures 7–8). Its alignment and position suggest drainage associated with utility or service buildings, possibly located within the adjacent woodland area.

6. Perimeter Wall and Structural Features

The perimeter wall is visible in multiple locations (Figures 6, 9), showing consistent width and alignment. A nearby buttress (Figures 11–12) shows signs of reused stone, possibly Roman in origin, reinforcing the interpretation of long-term occupation and adaptive reuse.

The integration of culverts and drains near the wall highlights the importance of water management in maintaining the structural integrity of the enclosure.

7. Engineered Waterway and Flood Control

An engineered waterway runs along the ridge line north-east of the amphitheatre area (Figures 17–18). Its alignment prevents uncontrolled runoff into the amphitheatre basin, demonstrating deliberate flood mitigation design.

This waterway transitions from boxed to open channel where appropriate, reflecting a sophisticated understanding of hydraulic pressure and sediment movement.

8. Exercise / Swimming Channel

8.1 Form and Dimensions

The exercise or swimming channel measures approximately 10–11 m wide, widening to c. 20 m at its feeder mouth (Figures 28–29). The eastern edge is straight, while the western edge is angled to maximise water intake under higher flow conditions.

8.2 Alignment and Length

The channel runs north-east to south-west, with a total length of approximately 545 m (Figures 30–33). Its alignment directly corresponds with the feeder waterway and timber beam feature described below.

9. Timber Beam Structure

A substantial dark oak timber beam is preserved in situ within the watercourse (Figures 24–26). The beam is located approximately 545 m south-west of the well, directly aligned with the channel's funnel mouth entrance 545 m to the north-east.

This alignment strongly suggests a deliberate hydraulic control feature, potentially acting as:

- A sluice or flow regulator;
- A weir or structural stabiliser;
- A component of a timber-lined channel phase.

The preservation of the beam beneath pasture overburden indicates anaerobic conditions favourable to long-term survival.

10. Artefactual and Structural Material

Figure 34 shows possible capping or lining slabs, alongside a ceramic drainage pipe approximately 16 inches in length. The pipe's weight and fabric are consistent with Roman or Romano-British drainage elements, further supporting the interpretation of a formally engineered water system.

11. Archaeological Significance

The hydrological system demonstrates:

- Advanced engineering responsive to landscape;
- Integrated supply and drainage serving multiple bathhouses;
- Long-distance water conveyance and flood control;
- Defensive considerations linked to the perimeter wall;
- High potential for preserved subsurface features.

The presence of timber elements, boxed culverts, ceramic pipes, and reused stone significantly enhances the archaeological importance of the site.

12. Conclusions

The evidence strongly supports the interpretation of a coherent, large-scale, and deliberately engineered hydrological network, most consistent with Roman or Romano-British water management principles. The system supplied clean spring water to bathhouses

A, B, and C, fed a substantial exercise channel, and managed waste and floodwater through a hierarchy of culverts and sumps.

This DBA concludes that the site possesses high archaeological potential, particularly in relation to water management infrastructure, and warrants careful consideration in any future ground disturbance

The site represents a fully integrated hydrological and bathing complex, incorporating:

a spring-fed well and sump, boxed and open culverts, multiple bathhouses arranged hierarchically, a large engineered exercise / swimming channel, timber and stone hydraulic controls, defensive and flood-mitigation features.

The system reflects advanced Roman or Romano-British water engineering, carefully adapted to local topography and long-term use.

Appendix

Fig 1 *Shows the spring /well supply route from well to main supply run. Coordinates: 51.57042, -3.11134*

Fig 2/3 (2) *Showing evidence of a possible small bridge structure that lays directly below the amphitheatre road. Coordinates: 51.56917, -3.10962*

Fig 2/3 (3) *Showing evidence of a possible small bridge structure that lays directly below the amphitheatre road. Coordinates: 51.56917, -3.10962*

Fig 4/5 (4) *Showing the grilled drain sump and rounded culvert terminal the rounded terminal head down from the SW (possibly the main drain run). The defence grilled sumps position is approx 45 m from centre of perimeter wall. Coordinates: 51.568, -3.10809*

Fig 4/5 (5) *Showing the grilled drain sump and rounded culvert terminal the rounded terminal head down from the SW (possibly the main drain run). The defence grilled sumps position is approx 45 m from centre of perimeter wall. Coordinates: 51.568, -3.10809*

Fig 6 *Shows the width and position of the perimeter wall. Coordinates: 51.56847, -3.10859*

Fig 7/8 (7) *Shows a 9" boxed culvert/ drain, it's position suggests possible drainage for utility buildings. Coordinates: 51.568, -3.10809*

Fig 7/8 (8) *Shows a 9" boxed culvert/ drain, it's position suggests possible drainage for utility buildings. Coordinates: 51.568, -3.10809*

Fig 9 *Again showing the perimeter wall position and width. Coordinates: 51.56847, -3.10859*

Fig 10 *showing the well/ spring fed supply channel departing the well position and the waterway main route. Coordinates: 51.57115, -3.11139*

Fig 11/12 (11) *Showing a buttress close to the culvert supply run. It shows signs of possible Roman stone reused. Coordinates: 51.57104, -3.11141*

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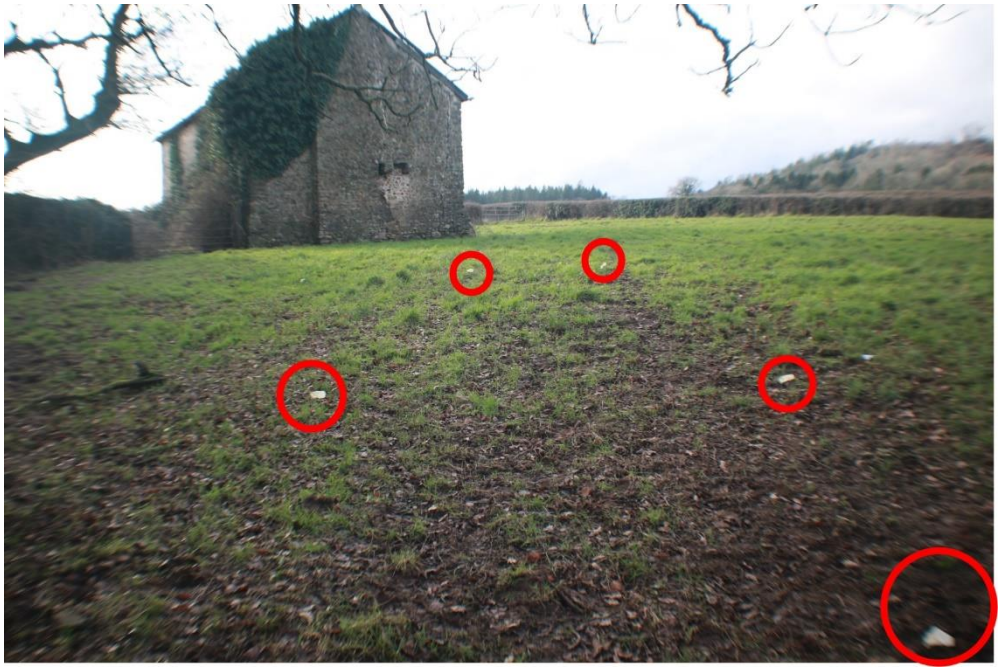

Fig 13/14 (13) *Showing suspected sump adjoined to the 6m diameter well. Coordinates: 51.57115, -3.11139*

Fig 13/14 (14) *Showsing suspected sump adjoined to the 6m diameter well. Coordinates: 51.57115, -3.11139*

Fig 15/16 (15) *Showing drainage pipes possibly from the bathhouse C that serves the amphitheatre. The pipes are clear SE to the amphitheatre server road. Coordinates: 51.56917, -3.10962*

Fig 15/16 (16) *Showing drainage pipes possibly from the bathhouse C that serves the amphitheatre. The pipes are clear SE to the amphitheatre server road. Coordinates: 51.56917, -3.10962*

Fig 17/18 (17) *Shows the length of the engineered waterway following the ridge before drop off NE keeping amphitheatre area from flooding. Coordinates: 51.568, -3.10809*

Fig 17/18 (18) *Shows the length of the engineered waterway following the ridge before dropoff NE keeping amphitheatre area from flooding. Coordinates: 51.56884, -3.10922*

Fig 19/20/21 (19) *Showing lots of stone scatter at the bathhouse B position. Coordinates: 51.57043, -3.11134*

Fig 19/20/21 (20) *Showing a possible paving stone or culvert cap stone at the bathhouse B position. Coordinates: 51.57054, -3.11147*

Fig 19/20/21 (21) *Showing drainage channels at the bathhouse C position. Coordinates: 51.56917, -3.10962*

Fig 22 *Showing an assortment of large and small stone positioned at the well area. Coordinates: 51.57115, -3.11139*

Fig 21/23 (23) *Showing position of the well route/ run. Coordinates: 51.57054, -3.11147*

Fig 24/25/26 (24) *Large stone slab near the well. Showing a worked face.*

Fig 24/25/26 (25) *Showing a large dark oak timber beam in situ. It's position is 545 m SW of the well/ spring fed waterway terminal for the training channel and it is in direct alignment to the channels funnel mouth entrance 545m NE.Also showing the pasture overburden. Coordinates: 51.56605, -3.11533*

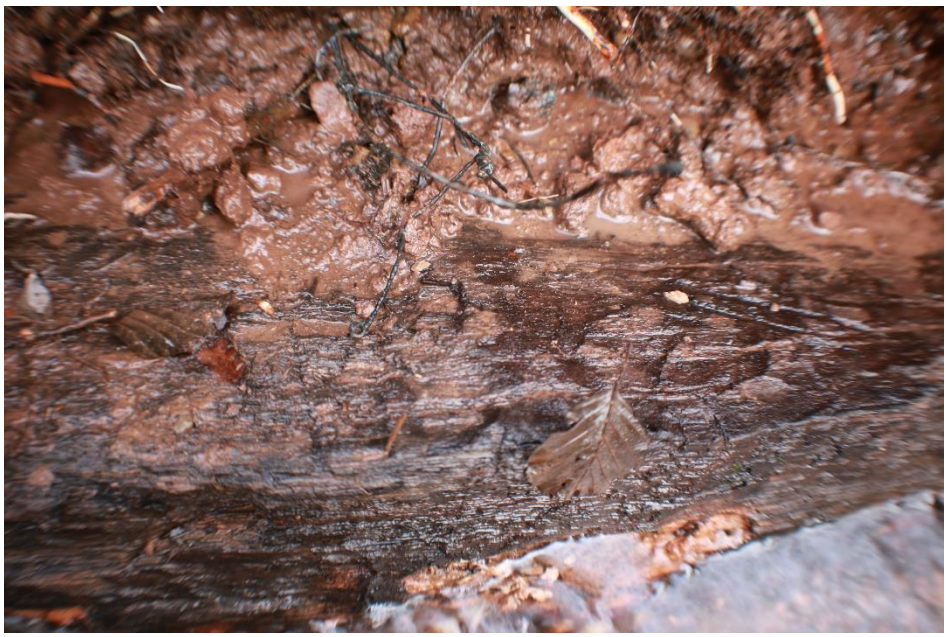

Fig 24/25/26 (26) *Showing a large dark oak timber beam in situ. It's position is 545 m SW of the well/ spring fed waterway terminal for the training channel and it is in direct alignment to the channels funnel mouth entrance 545m NE.Also showing the pasture overburden. Coordinates: 51.56605, -3.11533*

Fig 27 *Showing the exercise channel edge's, approx 10/11 m width. Including timber beam in situ and possible culvert tiles/slabs. Also showing it depository position terminal to drainage waterway. Coordinates: 51.56605, -3.11533*

Fig 28/29 (28) *Showing the exercise channel edge's, approx 10/11 m width.*
Also showing it depository position terminal to drainage waterway. Coordinates: 51.56605, -3.11533

Fig 28//29 (29) *Showing the exercise channel edge's, approx 10/11 m width.*
Also showing it depository position terminal to drainage waterway. Coordinates: 51.56605, -3.11533

Fig 30/31 (30) *Showing a field view of the exercise channel alignment. NE heading SW.*
Coordinates: 51.56605, -3.11533

Fig 30/31 (31) *Showing a field view of the exercise channel alignment. NE heading SW. Coordinates: 51.56605, -3.11533*

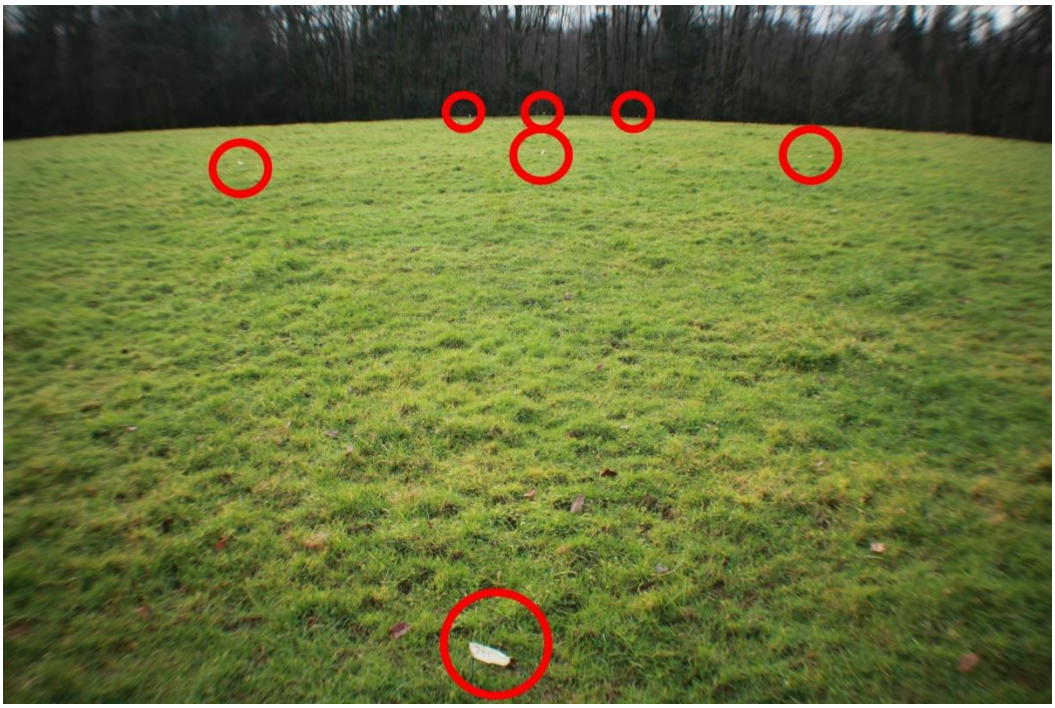

Fig 32/33 (32) *Showing the exercise channels route NE profile as it heads SW. Coordinates: 51.56605, -3.11533*

Fig 32/33 (33) *Showing the exercise channels route Ne profile as it heads SW. Coordinates: 51.56605, -3.11533*

Fig 34 *Shows a possible capping/ lining tiles/ slabs and a Roman drainage pipe if approx 16" in length and very heavy for it size. Coordinates: 51.56605, -3.11533*

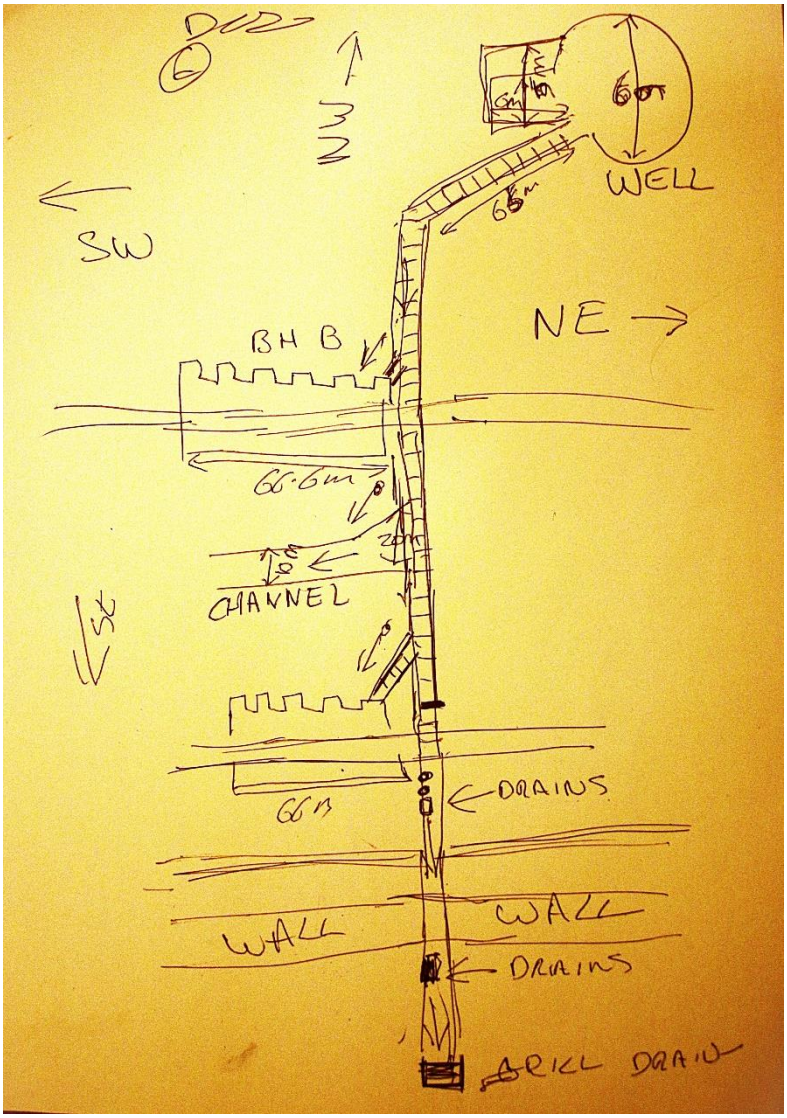

Fig 35: *Hand-drawn field sketch illustrating the spring-fed well, primary culvert run, associated drainage features, road crossings, bathhouse connections, and the engineered exercise/swimming channel. The sketch is orientated with cardinal directions indicated and is not to scale.*

Key Elements Shown in figure 35

1. Spring-Fed Well

- Circular feature at the northern (NE) end of the sketch.
- Interpreted as a spring-fed well c. 6 m in diameter.
- Acts as the primary clean-water source for the hydraulic system.

2. Well-Head Sump / Settling Feature

- Rectilinear feature immediately adjacent to the well.
- Interpreted as a sediment trap or regulating sump prior to water entering the main culvert.

3. Primary Boxed Culvert (Clean Water Supply)

- Linear, stone-lined culvert running generally NE–SW.
- Approx. 1 m wide.
- Total length c. 266 m (as measured on site).
- Supplies Bathhouse C, Bathhouse B, and downstream hydraulic features by gravity.

4. Road Crossings

- Horizontal lines crossing the culvert indicate road alignments.
- Culvert passes beneath these routes, demonstrating integrated planning of roads and water infrastructure.
- One crossing corresponds with the Amphitheatre Road.

5. Bathhouse C

- Located upslope and adjacent to the Amphitheatre Road.
- Receives clean water directly from the boxed culvert.
- Interpreted as the amphitheatre-facing bathhouse.

6. Bathhouse B

- Centrally positioned along the culvert run.
- Shown with lateral water input from the main culvert.
- Associated with stone spreads and structural remains identified in the field.

7. Drainage Culverts and Ceramic Pipes

- Smaller lateral features branching from bathhouses and road zones.
- Represent waste-water drainage pipes and subsidiary culverts, directing used water away from occupied areas.

8. Grilled Drainage Sump (Defensive / Control Feature)

- Located approximately 45 m from the perimeter wall.
- Stone-lined sump with iron grille cover.
- Interpreted as a combined security feature (preventing access via culvert) and a flow-control / debris trap.

9. Perimeter Wall

- Shown crossing the culvert alignment.
- Culvert passes beneath the wall, indicating planned integration rather than later intrusion.

10. Exercise / Swimming Channel Mouth

- Broad opening to the west of the main culvert.
- Channel width c. 10–11 m, widening towards the intake.
- Mouth is asymmetrical, flared to maximise water intake.
- Supplied by controlled flow from the culvert system.

11. Downstream Drainage Terminal

- Southern (SW) end of the sketch.
- Indicates continued drainage beyond the wall via a stone-lined or brick-built culvert.

Orientation and Notation

- **NE / SW / N / W** arrows indicate cardinal directions.
- Arrows within channels indicate direction of water flow.
- Measurements shown are field-measured approximations.
- Sketch is interpretative and schematic, based on repeated field observation and measurement.