

CPCCBC4018

APPLY SITE SURVEYS AND SET-OUT PROCEDURES TO BUILDING AND CONSTRUCTION PROJECTS

THEORY EXAM

Participant name	
------------------	--

FOR THE PARTICIPANT

Instructions

- You will complete written questions as outlined on the following pages. You must attempt all questions and provide enough detail in your responses to demonstrate your knowledge.
- It is anticipated that you should complete this assessment within two (2) hours, but additional time may be allowed upon negotiation with the Assessor.
- You must complete all questions unaided by the Assessor or other personnel but may refer to reference material as needed. All questions must be answered correctly for a 'Satisfactory' assessment outcome to be awarded.
- An oral examination may be allowed under certain circumstances, whereby your answers will be documented by another party.
- Any written questions that are incomplete, or not answered satisfactorily will need to be completed again after further training support.
- If you answer a question incorrectly but modify your response, put your initials next to the written change (or the Assessor must initial a verbal change).

Resources required

Pen

FOR THE ASSESSOR

Instructions

- Where oral examination has occurred, ensure that this is acknowledged in writing (e.g. FT001 and Assessor Comments)
- All questions must be satisfactorily demonstrated by the Participant for a Satisfactory determination (indicated by an Assessor tick to the right of the question).
- Assessors are to complete marking in pen of a different colour to the Participant.
- If the Participant verbally modifies their response, write in the modified response verbatim and put your initials next to the written change.

ASSESSOR COMMENTS

As necessary, outline:

- Details on reattempts, alternative arrangements or reasonable adjustments made.
- Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

Q1. Explain why we should determine the orientation of the building according to the plans.

Answer

Should reflect but is not limited to: In Australia, living areas should generally face north so that sunlight can come into the house during the day. Successful orientation rotates the building to minimise energy loads and maximize free energy from the sun and wind. The exact orientation recommended for different climate zones is outlined under Star ratings and variations. Orientation refers to the way a building is placed on its site to take advantage of climatic features such as sun and cooling breezes. Good orientation reduces the need for auxiliary heating and cooling and improves solar access to panels for solar photovoltaics and hot water. It takes account of summer and winter variations in the sun's path as well as the direction and type of winds.



Q2. Discuss the information you can source from the specifications.

Answer

Should reflect: information relevant to the product/s, materials and work required by the construction contract. Aspects of the works are generally specified by product or by workmanship.
e.g. Products may be specified according to an Australian Standard, a description of attributes, naming (perhaps allowing equivalent alternatives) or by nominating suppliers.
Workmanship may be specified by compliance with manufacturers requirements, reference to a code of practice or standards, or by approval of samples or scheduled testing.



Q3. The construction project must comply with the National Construction Code (NCC). What does this mean.

Answer

Should reflect but is not limited to: Materials, form of construction or design must meet the Performance Requirements or Deemed-to-Satisfy (DtS) Provisions set by the NCC. Assessment Methods, which are located within the General Requirements of the NCC are used to determine whether a solution complies with the relevant NCC Performance Requirements.

This means that evidence of suitability must be provided for each material and form of construction, this may be that the work adheres to specific Australian Standards specified in the NCC, may also be verified using testing and inspection, methods may be compared against the DtS provisions to demonstrate equal or superior outcomes or expert judgement may be accepted regarding procedures or material from a relevantly qualified and experienced person such as a technical expert.



Q4. Describe the principles of establishing control during set-out surveys.

Answer

Should reflect but is not limited to: Control marks should cover the entire area of the project,. Measurements for the control survey should be made to a uniformly high standard of accuracy. Control marks must be as stable as possible.

Control marks should be positioned on high ground, if possible, about their possible future use (for example, the collection of topographical information, setting out during construction, making check measurements upon completion of the project).

Control marks are referenced to aid recovery of the point should it be disturbed.



Q5. What is linear measurement in surveying?**Answer**

Should reflect what linear measurement is in surveying.



e.g. Linear measurement in surveying is the determination of the distance between two points on the surface of the earth is one of the basic operations of surveying.

Q6. Provide two (2) examples of surveying that uses linear measurements.**Answer**

1. Should reflect but is not limited to: chain surveying



2. Traverse surveying

Q7. Listed below are principles of linear measurement for small surveys. Briefly explain what each principle means.**Answer**

Principle	Explanation
Working from whole to the part	e.g. Treat the area as a whole, then break it down into several triangles rather than the reverse.
Form well-conditioned triangles	e.g. Form angles preferably between 30° and 120°. Aim for equilateral figures based on at least one long backbone line.
Economy of lines	e.g. Use as few measured lines as is necessary while avoiding obstacles and steep slopes, but using sufficient check lines to minimise errors



Q8. Listed below are two (2) methods of linear measurements. Briefly explain each.

Answer

Type of linear measurement	Explanation
Direct method	e.g. the distance is measured during the actual fieldwork.
Optical method	e.g. the distance is computed indirectly using the tacheometer.



Q9. What is horizontal angular measurement in surveying?

Answer

Should reflect but is not limited to: Horizontal angular measurement is the determination of the angle between two survey lines.



Q10. Why are the linear and angular measurements necessary in surveying?

Answer

Should reflect but is not limited to: Both are necessary because a survey line can only be plotted if its length and direction are both known. The angular measurement determines the direction of a survey line.



Q11. Why is it relevant to have knowledge of geometry when conducting surveying activities?

Answer

Should reflect but is not limited to: Geometry is a branch of mathematics that studies the shapes, positions, and dimensions of objects. When surveying, you must measure distances, angles, and directions between points by using geometric principles of measurements.



Q12. Why is it relevant to have knowledge of trigonometry when conducting surveying activities?

Answer

Should reflect but is not limited to: Geometry is a branch of mathematics that studies the relationships between side length and angles of triangles. Trigonometry is used when measuring the height and angles of land or the elevations of certain points of a mountain.



Q13. What components are needed when using an optical level and how are these used?

Answer

Should reflect: components such as precision telescope with crosshairs and Stadia marks mounted on tripod legs adjusted with levelling screws. Must be set up on a level and firm surface, the precision telescope is mounted on a tripod. This telescope can freely rotate 360° in a horizontal plane. Stadia marks on the precision telescope are usually at ratios of 100:1



Q14. What is the difference between a dumpy level and a theodolite?

Answer

Should reflect: The difference is in their working. Dumpy level can be used only for vertical measurements while a theodolite functions in both horizontal and vertical measurements.



Q15. Describe a two-peg test.

Answer

Should reflect: A two peg test checks whether your dumpy level is capable of showing a true horizontal reading. This is vital to ensure your measurements are accurate and reliable. The two peg test tells you the measurement that your level is out over the distance you test over. To achieve a two-peg test, Measure out a 60-metre line on a relatively flat piece of ground. Marking each end. Set up your dumpy level halfway between each of the pegs (30 metres along the line). Once levelled, using another person, place your staff on point A, and record the height of the peg as accurately as possible. Write this figure down, next, do the same at point B and record the height. Next, move your dumpy level to approximately 3 m away from point A, set up and level the instrument.

Record the height of point A and Point B again and write these figures down. Compare the readings, If the instrument is out of adjustment, it will read a different value during the 2nd reading. To adjust, move the horizontal crosshair to the correct reading by loosening one of the capstan screws and tightening the other.



Q16. Discuss benefits of using electronic distance measuring (EDM) equipment.

Answer

Should reflect but is not limited to: The EDM is able to measure the azimuth, or angle from north, and elevation of a point. The comparison of the returning signal to that emitted by the EDM allows the unit to determine the distance between the unit and the target surface.

Data obtained through the EDM is stored in a data collector, which can then be downloaded for processing using a software.

A prism or a target is used to reflect the light beam back to the EDM.



Q17. Identify one operational and one functional feature for each of the levelling and surveying devices listed below.

Answer

Device	Operational features	Levelling features
Laser level: manual-levelling laser	e.g. A manual levelling laser requires the operator to manually level the unit by turning the thumbs screws and getting the unit levelled by looking at the bubble vials.	e.g. The v-groove shape of the device fits contours of pipe and conduits
Laser level: dot laser levels	e.g. Allows the user to establish plumb lines or right angles by projecting laser dots vertically, horizontally, or at right angles.	e.g. Can project two, three, or five laser dots at the same time. e.g. Laser dot projected can be used to transfer a point from the floor to the ceiling and establish a level plane.



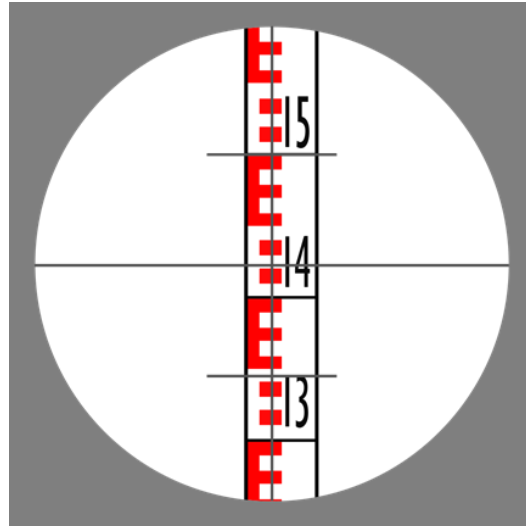
Q18. Describe features of the water level.**Answer**

Should reflect but is not limited to: Utilises surface of water to establish a local horizontal plane of reference, which determines the apparent inclination of a surface. The simplest water level is a section of clear tubing, partially filled with water. The ends are held vertical, and the rest of the tubing lies on the ground or floor. The water level at each end of the tube will be at the same elevation, whether the two ends are adjacent or far apart, so a line between them will be horizontal at its midpoint. A cheap, easily procured method for simple levelling.

**Q19. You are responsible for checking levels in an excavation. From the drawings for the job you know the floor level is RL 12.000. The floor of the excavation is level (0% grade).****You find a peg, which identifies the RL as 14.50.****The plane of collimation measures 0.65m above the peg.****On what level would you set the receiver on the stave to achieve the desired FL of the excavation? Show your calculations.****Answer**

peg RL	14.500
+Plane of Collimation	0.650
	= 15.150
-Floor level RL	12.000
Height of receiver	= 3.150m





Q20. Using the picture above, what distance is the staff from the instrument?
Show workings.

Answer

Should reflect: Top stadia reading – bottom stadia reading x 100



$(1.500 - 1.345) \times 100$

$= .155 \times 100$

$= 15.500$ or 15.5m

Q21. Discuss errors in measured distances due to site characteristics and measurement methods.

Answer

Should reflect but is not limited to: Instrumental errors include issues such as staff not vertical, loose tripod legs or no adjustment made on the instrument. Human Errors will include those such as incorrect bookings, incorrect readings, incorrect mathematics and no checking. Human errors may also include Staff not fully extended or angled; bubble not centred before each reading, poor instrument station or change point.



Environmental Errors include those related to wind or heat affecting viewing or stability.

Q22. Discuss the purpose of setting out gridlines for the construction project.

Answer

Should reflect but is not limited to: Construction drawings and plans should include the site layout plan and floor plans. The plans would then have grid lines with corresponding dimensions. The grid lines allow the reader to make references in terms of position or location of various elements in the project.



A surveyor would then set out grid lines on the construction site. The surveyor will acquire a survey plan that indicates the true coordinate control points near the construction site and then transfer and establish new control points if necessary. From these control points, grid lines can then be established in the construction site.

The surveyor's field team will usually set up the gridline reference points a few metres away from the building perimeter.

Q23. Discuss situations where you need to draw up a contour plan.

Answer

Should reflect but is not limited to: The contour plan is needed for sloping blocks to indicate where cut and fill is needed and to calculate volumes of fill needed to achieve the desired level for the construction. Contour plans must be drawn in accordance with grid levels, specified tolerances, and stated contour intervals.



Q24. When do you draw longitudinal sections from RLs.

Answer

Should reflect but is not limited to: to show a pipeline in sections, showing the grades, chainage, and details. To show what the reduced level is at the chainage or distances taken in the survey readings, and where the pipes or drains will be in relation to these levels. Provided for all proposed stormwater drainage lines.



Q25. How do you determine the tolerances when determining levels and clearances from given grades for underground pipework?

Answer

Should reflect but is not limited to: refer to AS/NZS 3500.2 and 3500.3 to give you the grades necessary for underground pipework. When designing drainage and pipelines you need to refer to these standards to ensure that all specified tolerances are met. Once you have the reduced levels, you can then design the drainage or pipework in accord with the AS/NZS 3500 to ensure that the right grades for distances involved are met.

☐

Q26. How do you calculate elevation slope as a decimal or a percentage?

Answer

Should reflect but is not limited to: to find change in elevation as a decimal is “rise over run,” meaning the rise (the change in vertical distance) divided by the run (the change in horizontal distance). multiply the decimal by 100 to find the percentage.

☐

Q27. How do you calculate elevation slope in degrees?

Answer

Should reflect but is not limited to: When calculating elevation slope in degrees, think of the problem as a right triangle. Take “rise over run” and use arctangent ($\tan^{-1}$) to find theta (θ) – that’s your grade in degrees.

☐

CPCCBC4018

APPLY SITE SURVEYS AND SET-OUT PROCEDURES TO BUILDING AND CONSTRUCTION PROJECTS

WORKBOOK

Participant name	
------------------	--

FOR THE PARTICIPANT

Instructions

- You will complete written activities as outlined on the following pages. You must attempt all questions and provide enough detail in your responses to demonstrate your knowledge.
- The timeframe for these tasks will be established by your Assessor or Training Provider. Additional time may be allowed upon negotiation with the Assessor.
- You must complete all questions unsisted by the Assessor or other personnel but may refer to reference material as needed. All questions must be answered correctly for a 'Satisfactory' assessment outcome to be awarded.
- An oral examination may be allowed under certain circumstances, whereby your answers will be documented by another party.
- Any written questions that are incomplete, or not answered satisfactorily will need to be completed again after further training support.
- If you answer a question incorrectly but modify your response, put your initials next to the written change (or the Assessor must initial a verbal change).

Resources required

Pen

FOR THE ASSESSOR

Instructions

- Where oral examination has occurred, ensure that this is acknowledged in writing (e.g. FT001 and Assessor Comments)
- All questions must be satisfactorily demonstrated by the Participant for a Satisfactory determination (indicated by an Assessor tick to the right of the question).
- Assessors are to complete marking in pen of a different colour to the Participant.
- If the Participant verbally modifies their response, write in the modified response verbatim and put your initials next to the written change.

ASSESSOR COMMENTS

As necessary, outline:

- Details on reattempts, alternative arrangements or reasonable adjustments made.
- Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

NOTE

At times, you will be provided with a specific context to which you must respond, otherwise it is anticipated that you will use a workplace of your choosing (your own, or hypothetical) to provide the context to the task.

At all times, the responses in your assessment must reference **Australian** (Queensland or Federal) documentation, including legislation, regulations, codes of practice, standards and guidance publications.

ACTIVITY 1

Access and review the working drawings and specifications contained in the project plan below:

[Case Study: Curtin, Australian Capital Territory](#)

Answer the following questions:

- What is the size of the land?
- What is the size of the house, excluding the garage and laundry?
- How many bedrooms does the house have on the ground floor?
- Based on the working drawings, in which cardinal direction is the terrace oriented?
- What was used to replace bricks that were removed?

a) What is the size of the land?

Should reflect: 825m²

b) What is the size of the house, excluding the garage and laundry?

Should reflect: 185m²

c) How many bedrooms does the house have on the ground floor?

Should reflect: Two (2)

d) Based on the working drawings, in which cardinal direction is the terrace oriented?

Should reflect: East

e) What was used to replace bricks that were removed?

Should reflect: reconstituted timber weatherboards

**Satisfactory
Outcome**



ACTIVITY 2

Review the plans and elevations linked below and answer the questions that follow.

[YourHome Design For Place - 3BR + Study All plans and elevations](#)

For the purpose of this assessment, this case study scenario is based in your state/territory.

- What is the building classification for this project?
- In which volume of the current NCC can you find the building codes and standards for this building classification?
- What climate zone is applicable to your work area according to the NCC? Specify your state/territory for your assessor's reference.
- List state/territory laws used in your state/territory as reference in determining the additions to these building codes.

a) What is the building classification for this project?

Should reflect: Class 1a.

b) In which volume of the current NCC can you find the building codes and standards for this building classification?

Should reflect: Volume 2

c) What climate zone is applicable to your work area according to the NCC? Specify your state/territory for your assessor's reference.

Should reflect correct climate zone for participants work area. Climate zones located at: <https://abcb.gov.au/resources/climate-zone-map>

e.g. Brisbane, Queensland = climate zone 2

d) List state/territory laws used in your state/territory as reference in determining the additions to these building codes.

Participant must list state/territory laws used as reference in determining the additions to the building codes.

When assessing the candidate's response, the assessor must check the laws from the relevant state/territory* which are used in determining the additions to building codes listed above. This is found in NCC Volume Two

E.g., if the candidate is based in NSW.

Model answers are provided below for the assessor's additional reference. These model answers are based on variations to the building codes for New South Wales.

- Environmental Planning and Assessment Act
- Environmental Planning and Assessment Regulation
- Swimming Pools Act and Swimming Pools Regulation

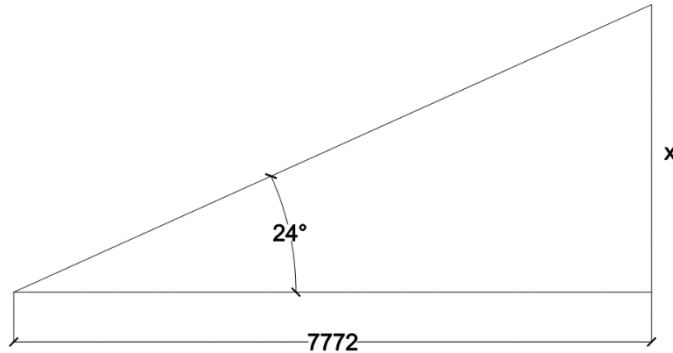
Satisfactory Outcome



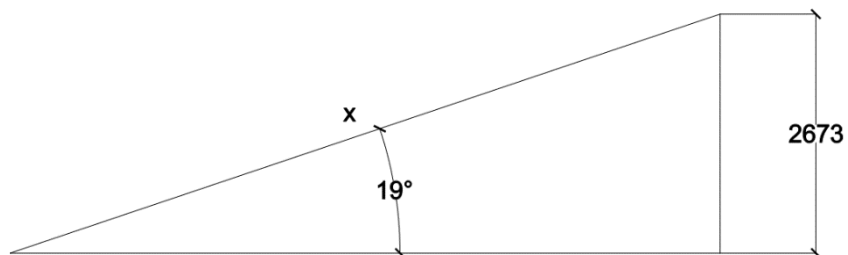
ACTIVITY 3

Determine the value of x in each of the following trigonometric problems. Calculators are permitted.

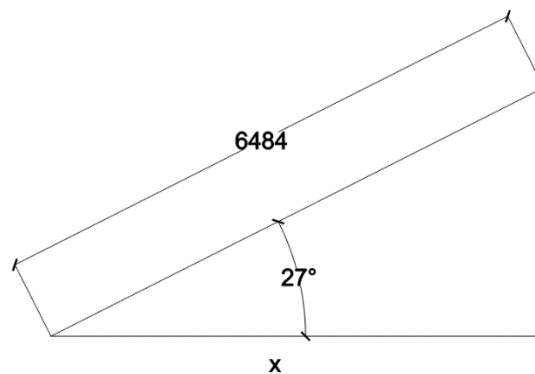
a) Answer: 3500



b) Answer: 8402



c) Answer: 5788

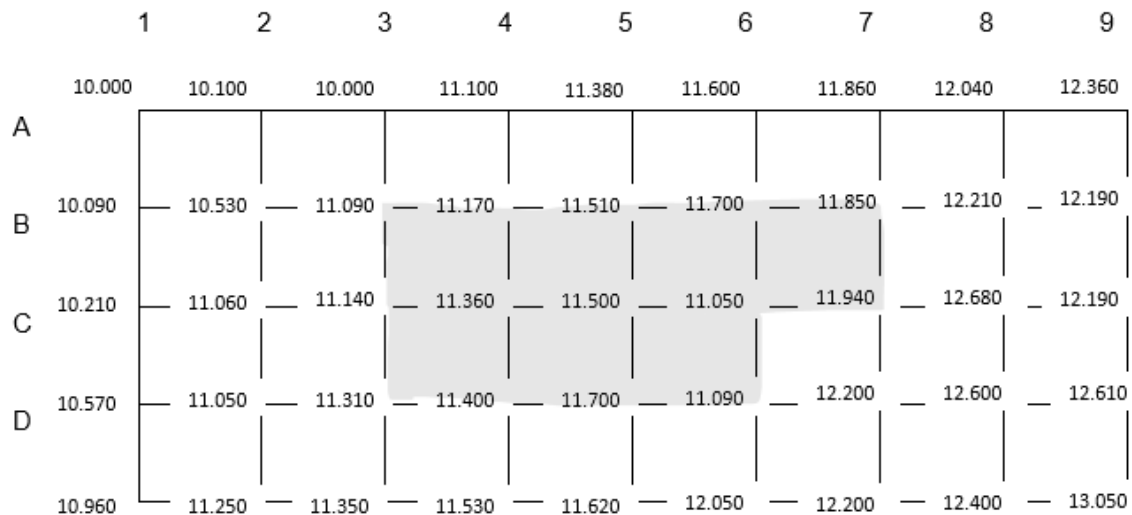


Satisfactory
Outcome



ACTIVITY 4

- a) Using the grid pattern below, complete the table to calculate how much soil is needed to be removed from the highlighted section of the grid (*represents the intended building*) to a given RL of 11.000. Grid measurements = 5m x 5m. (*first row has been completed for you*)
- b) Suggest a new RL for the site that will require no spoil removal, only cut and fill.



Volume of excavation- Grid method		Formation level RL	RL =11.000
Ground level	Corner Height "H"	No. of Squares occurring "N"	Product H & N
B3	$11.009 - 11.000 = 0.090$	1	0.090
B4	$11.170 - 11.000 = 0.170$	2	0.340
B5	$11.510 - 11.000 = 0.510$	2	1.020
B6	$11.700 - 11.000 = 0.700$	2	1.400
B7	$11.850 - 11.000 = 0.850$	1	0.850
C3	$11.140 - 11.000 = 0.140$	2	0.280
C4	$11.360 - 11.000 = 0.360$	4	1.440
C5	$11.500 - 11.000 = 0.500$	4	2.000
C6	$11.850 - 11.000 = 0.850$	3	2.550
C7	$11.940 - 11.000 = 0.940$	1	0.940
D3	$11.310 - 11.000 = 0.310$	1	0.310
D4	$11.400 - 11.000 = 0.400$	2	0.800
D5	$11.700 - 11.000 = 0.700$	2	1.400
D6	$11.890 - 11.000 = 0.890$	1	0.890
		28	14.310
Volume =	Grid x Grid x Total Product ÷ 4		
		$14.310 \div 28 = 0.511$	
	$(5 \times 5 \times 14.310) \div 4$	$0.511 + 11.000 = 11.511$	
		Set block at a RL of 11.511 for no cut and fill only	
	$357.750 \div 4$		
	89.438		

a) Calculate how much soil is needed to be removed from the highlighted section of the grid (represents the intended building) to a given RL of 11.000. Original grid measurements = 5m x 5m.

$$(5 \times 5 \times 14.310) \div 4$$

$$357.750 \div 4$$

89.438 m³ can be rounded to 90 m³

b) Suggest a new RL for the site that will require no spoil removal, only cut and fill.

$$14.310 \div 28 = 0.511$$

$$0.511 + 11.000 = 11.511$$

Set block at a RL of 11.511 for no cut and fill only

**Satisfactory
Outcome**



CPCBC4018

APPLY SITE SURVEYS AND SET-OUT PROCEDURES TO BUILDING AND CONSTRUCTION PROJECTS

PRACTICAL ASSESSMENT

Participant name	
------------------	--

FOR THE PARTICIPANT

Instructions

- The tasks outlined on the following pages will require performance of normal workplace activities, as a result of a structured activity set by an observer in the workplace or a simulated activity set by your Assessor/Observer.
- The timeframe for these tasks will be established by your Assessor/Observer in consideration of location conditions and industry requirements.
- You must complete all tasks assisted by the Assessor or other personnel, unless the supervisor notes assistance.
- You must attempt all tasks (and itemised steps) for a 'Satisfactory' assessment outcome to be achieved.
 - For an observation conducted that is incomplete, or without satisfactory performance, the observation will need to be completed again after further training support.

FOR THE ASSESSOR/OBSERVER

Instructions

- The following observation record should be used to judge and record your observations of the Participant as they complete the task(s) set. You must record your observations of the Participant's performance.
 - For each occasion, indicate the task performed and whether it was a simulation or workplace-based task.
 - Any simulated assessment must ensure the Participant still performs under workplace conditions which reflect industry standards.
 - In the comments, provide clear detail regarding the task that the Participant was required to do (e.g. PPE used, materials handled, attachments connected, plant types).
- All steps must be satisfactorily demonstrated by the Participant for a 'Satisfactory' determination (indicated by an Assessor tick to the right of each itemised step, or an Observer tick to the right of each itemised step, and confirmation by an Assessor in the Assessor Comments).
 - Where you have determined that one or more task steps have not been satisfactorily demonstrated, provide the Participant with additional support and outline details of such assistance in the Assessor/Observer Comments. Allow the Participant two (2) further opportunities to demonstrate the task again to allow an opportunity for a 'Satisfactory' assessment outcome to be achieved.
 - If after three (3) attempts the Assessor determines that the Participant cannot demonstrate the required steps, a 'Not Satisfactory' outcome is to be determined.

TASK OUTCOME					
Task	Date	Task Type (Tick)	Location	Task outcome (Tick)	
				Satisfactory	Not Satisfactory
Task 1		☐ Workplace ☐ Simulation		☐	☐

ASSESSOR COMMENTS: GENERAL

As necessary, outline:

- Details on reattempts, alternative arrangements or reasonable adjustments made.
- Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

ASSESSOR COMMENTS: PRACTICAL TASK 1	
☐ Individual student (as named on cover page) ☐ Multiple students [☐ All from Attendance Report, ☐ Specific students involved – identify students]	
Task	Provide detail
1.1A.	Specify how participant identified current plans: e.g. according to version number.
1.1B.	Specify(✓) surveying device collected and operated: ☐ Electronic distance measuring (EDM) equipment ☐ Laser level: manual-levelling laser ☐ Laser level: dot laser level ☐ Optical (Dumpy) level ☐ Water level ☐ Theodolite ☐ Other (please specify):
1.1B.	Specify(✓) levelling device collected and operated: ☐ Electronic distance measuring (EDM) equipment ☐ Laser level: manual-levelling laser ☐ Laser level: dot laser level ☐ Optical (Dumpy) level ☐ Water level ☐ Theodolite ☐ Other (please specify):
1.1D. 1.1E. 1.1F.	Specify site RL calculations were made: e.g. residential house site in new housing development with gradual slope
1.1G.	Specify errors explained due to site characteristics: e.g. extreme wind or temperature cause errors in readings
1.1H.	Specify(✓) digital tools operated to communicate with others: ☐ Mobile phone ☐ UHF/ 2-way ☐ PC via intranet ☐ PC or mobile for email ☐ Other (please specify):
1.3A. 1.3B. 1.3C. 1.3D. 1.3E.	Specify drainage and pipeline situations where calculations were made to determine grades. e.g. typical residential water line and pipes