Australian Government

Department of Defence

Estate and Infrastructure Group

Initial Business Case (IBC)

PROJECT NUMBER: R8099

PROJECT NAME: RAAF BASE TINDAL REDEVELOPMENT STAGE 6

PROJECT LOCATION: KATHERINE, NT

SPONSOR ENDORSEMENT:

Name:

Position:

Date:

CFO FINANCIAL ENDORSEMENT:

Name:

Position:

Date:

APPROVING DELEGATE:

Name:

Position:

Date:

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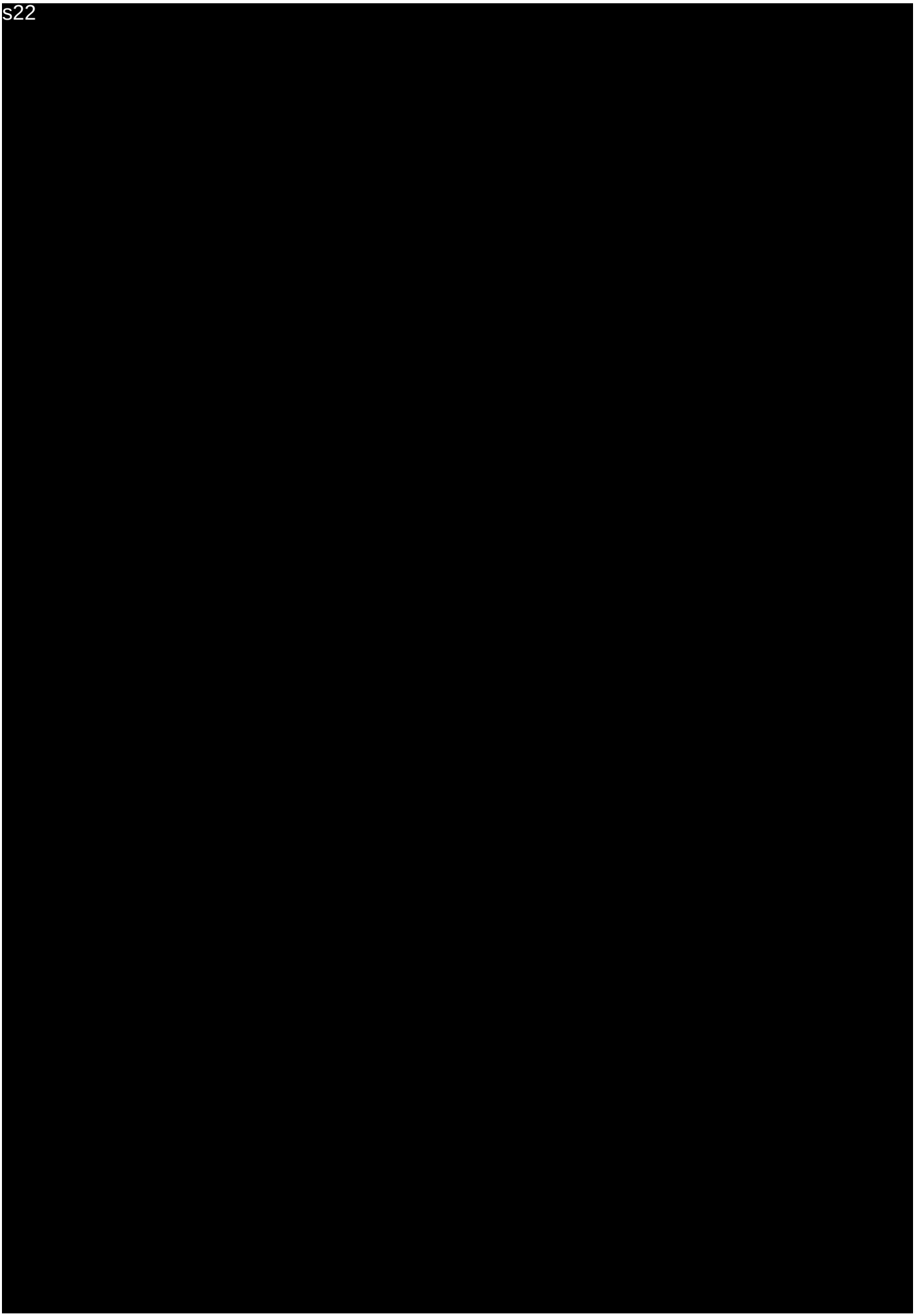

Project Element	Option 1 – High Priority Only ($m)	Option 2 – High & Medium Priority ($m)	Option 3 – Full Scope ($m)	Option 4 – Do Nothing ($m)
Northern Regional Operations Centre	5.550	5.550	5.550	0.000

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Earth Covered Buildings	0.000	0.000	1.125	0.000

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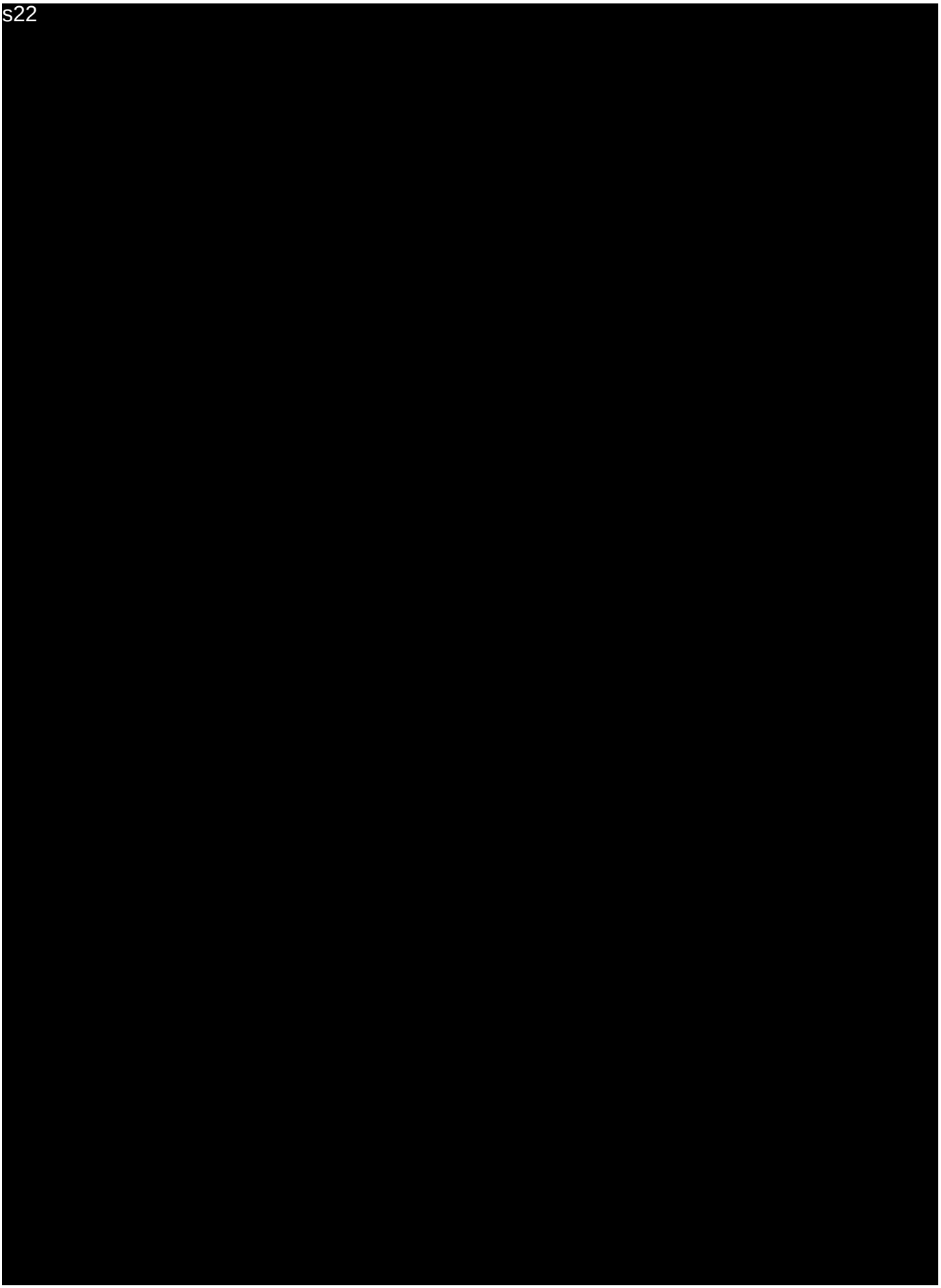
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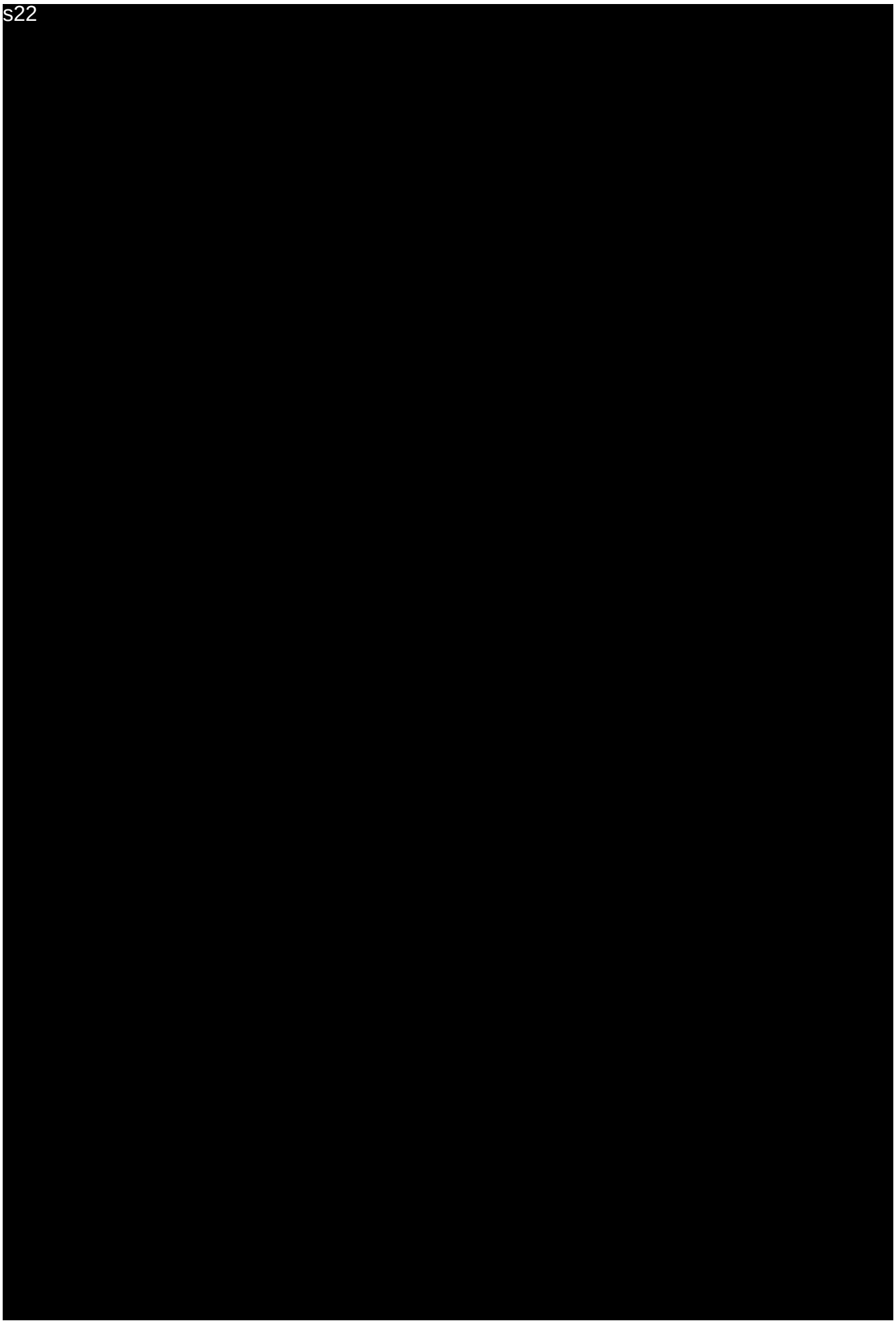

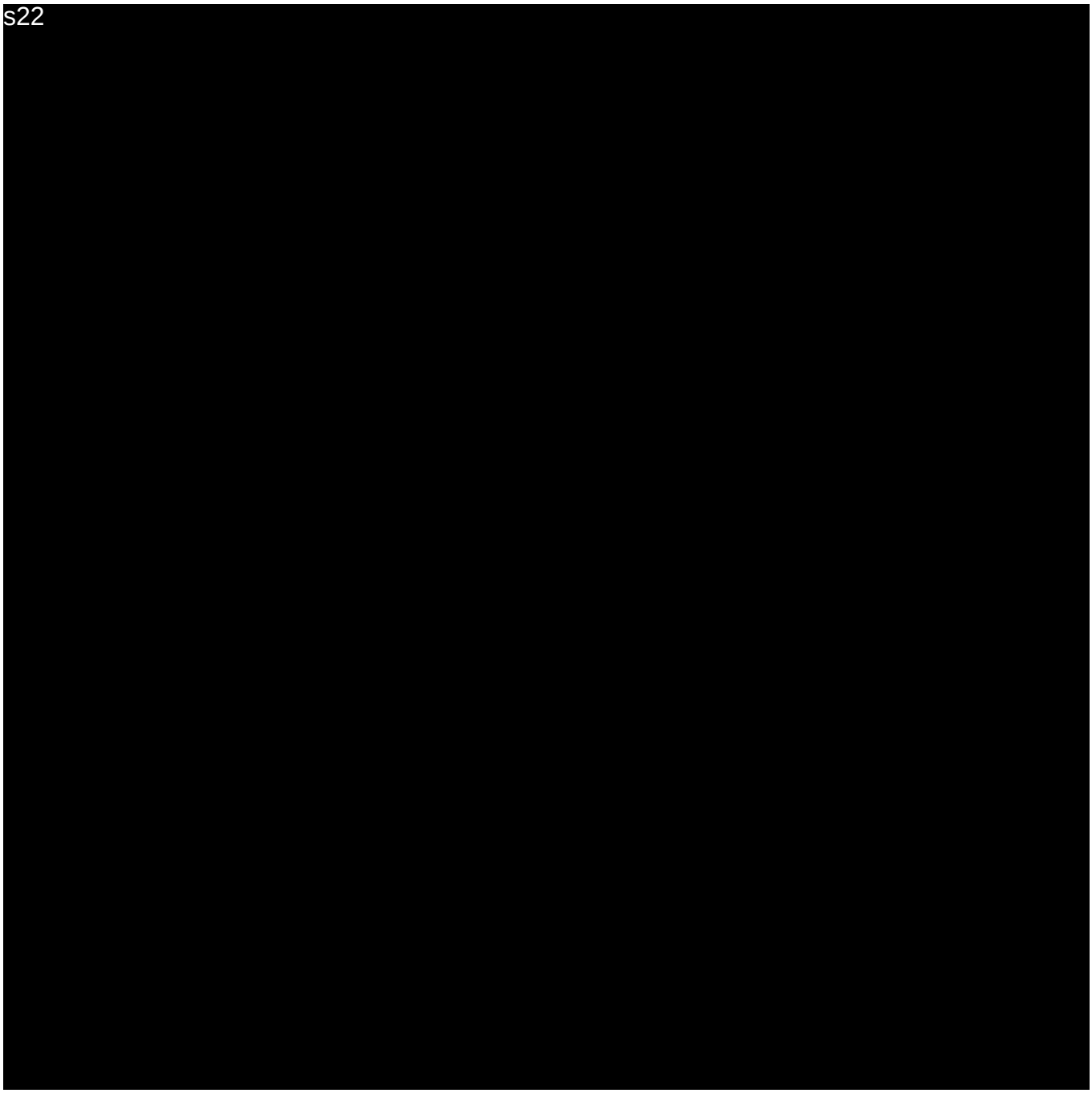
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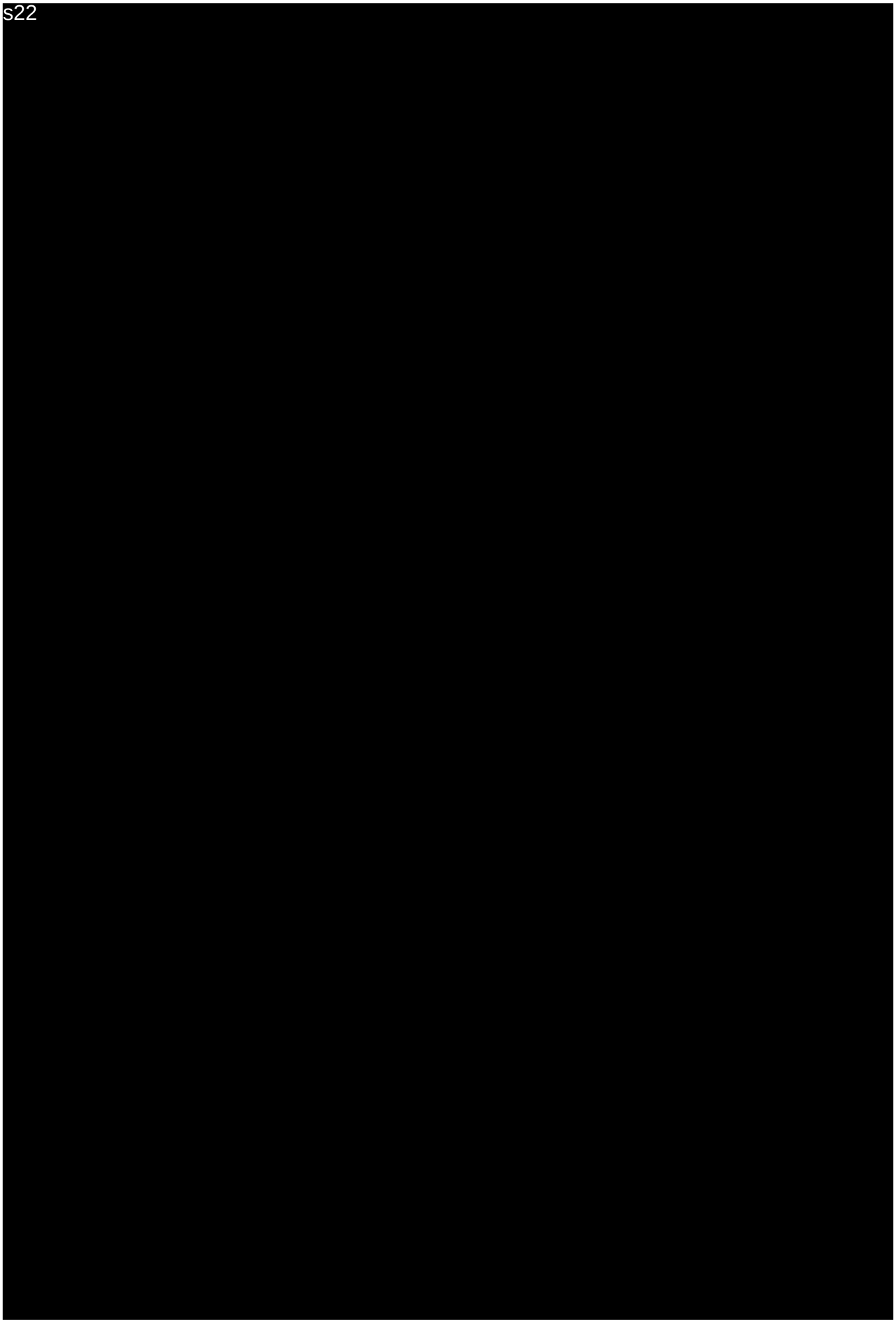
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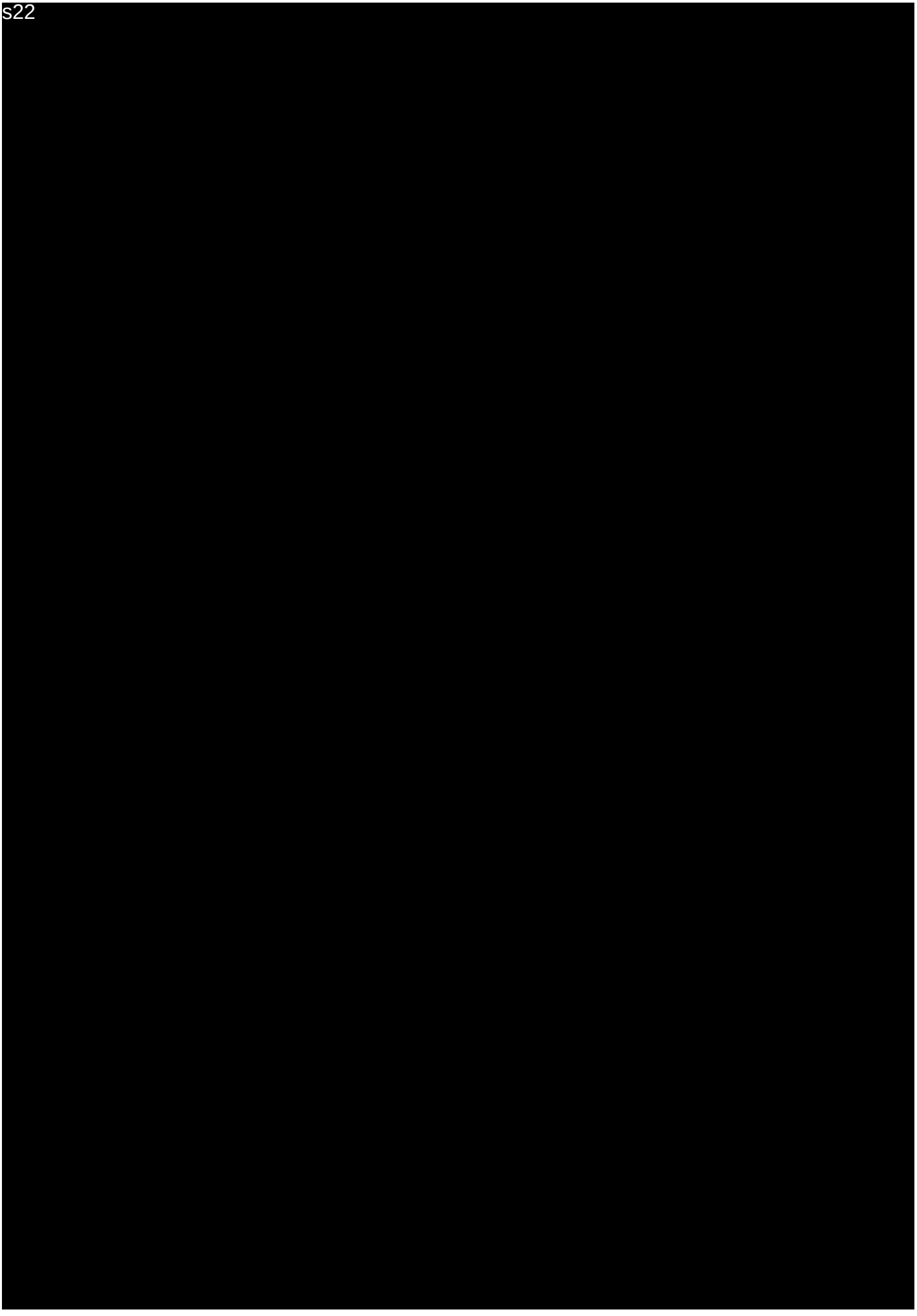

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Earth Covered Buildings	During the site visit on 7-10 December 2015, it was apparent that the Earth Covered Buildings (Building numbers 1018, 1019, 420, 349 and 452) inspected on site suffered from a lack of vegetation or other protective membrane. This has led to significant erosion to these structures, which compromises the ongoing slope stability of the mounded earth. Without remediation, further erosion of these structures is likely to take place, leading to reduced earth cover, increased sediment displacement and an increase in the level of maintenance required.

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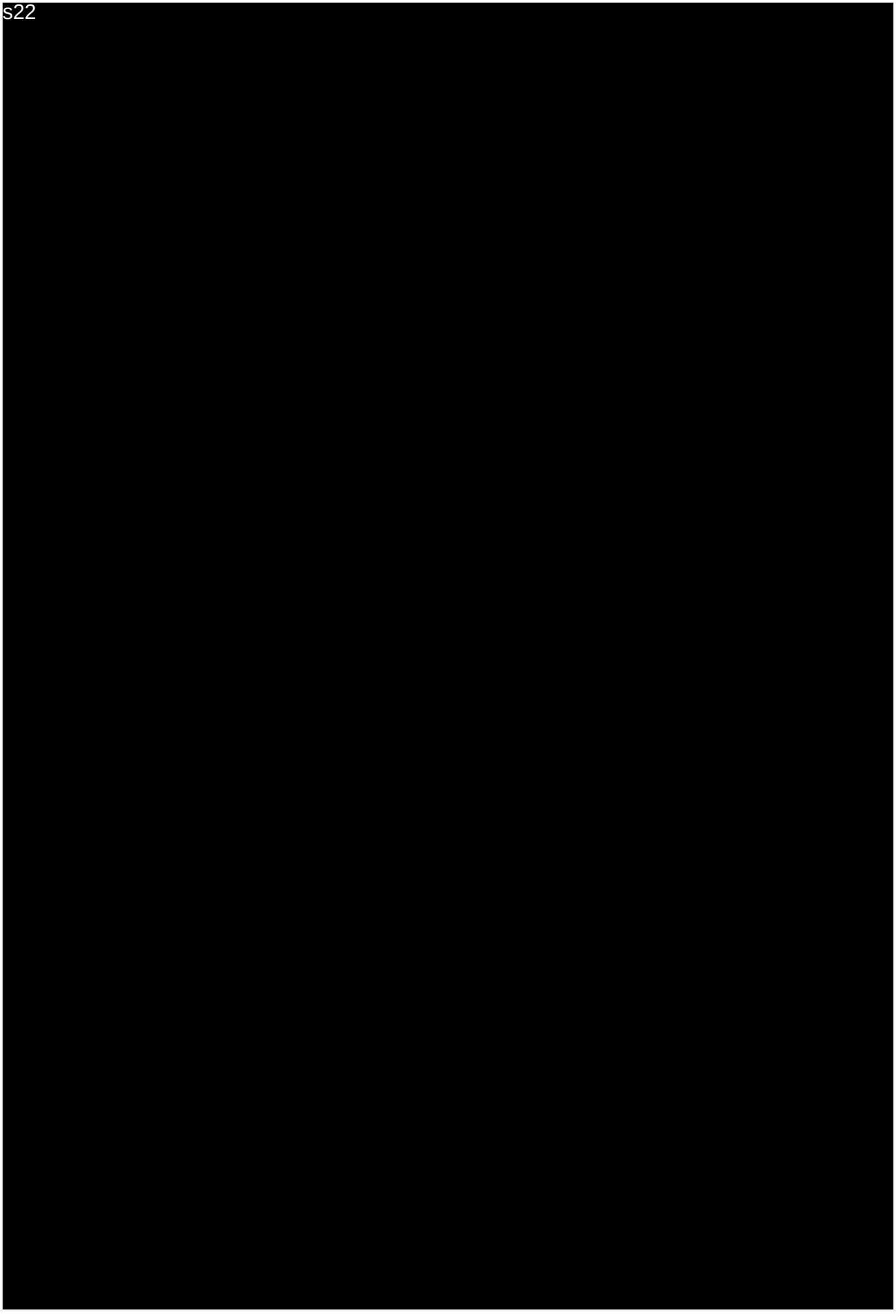
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Requirement 1.3 Northern Regional Operations Centre (NROC)

Requirement 1.3.1 NROC (Building 452)

37. **Overview.** Building 452 s33 [redacted]. The building must also remain occupied and operational with minimal downtime during any upgrade works designed to facilitate this requirement.

38. **Current State - Overall.** The original building and mechanical system was designed as a hardened facility with earth covering. The subsequent chiller replacement is external to the earth covered structure and does not provide hardening. s33 [redacted]

39. **Current State - Architectural.** The existing facility is in reasonable condition however in need of general maintenance to the building fabric. The following specific issues were advised by site based stakeholders or identified during the site inspection.

a. The existing ablutions arrangement consists of shared male and female. This arrangement is not considered unisex or segregated and would not comply with the National Construction Code (NCC) or Defence Standards. The arrangement will require reconfiguration to comply.

b. Areas below the access floor have evidence of water damage and mould. The entire access floor should be inspected and repaired where necessary.

c. Existing stair treads are not compliant with the NCC.

d. Architectural upgrade works associated with mechanical services upgrades.

e. Existing doors and door hardware are damaged and require repair.

f. General patch and painting is required throughout.

g. The fire rating of the generator and associate fuel storage requires review by a fire engineer to check compliance against current standards.

h. The Uninterruptible Power Supply (UPS) battery storage fire rating requires review by a fire engineer to check compliance against current standards.

40. **Current State - Mechanical.** The offices are conditioned by 18 chilled water fan coil units that appear to be original and in poor condition. There is significant rust on the fan coil unit casing, valves and chilled water pipe work. Each room has carbon dioxide (CO_2) and humidity sensors that should provide input for the operation of the outside air system. From the direct ducted return air paths, fan coil unit (FCU) noise can be clearly heard from within the room. Due to the acoustic sensitivities of the operations within these spaces, this should be rectified. The existing ductwork appears to be in reasonable condition and may be reused.

41. The centralised outside air system located within the internal plant room appears to be operating in satisfactory condition. A variable-speed drive (VSD) is provided to modulate the flow rate of outside air depending on room occupancy, which is determined by the CO_2 sensors. Additional equipment is recommended to further enhance the control of relative humidity levels as there is a current issue with mould in the building.

42. The central chilled water system was recently replaced in 2013. Two external air-cooled Carrier chillers at approximately 290 kW each have replaced the two original internally located water-cooled chillers and cooling towers. The redundant equipment has been isolated and still remains within the building. Based on the new chiller capacities and Ø100 mm pipe work, the chillers are most likely arranged in a lead/lag arrangement.

43. The existing chilled water header has been reused but as a minimum requires further work to mitigate water leakage issues. Spare connections are isolated with the butterfly valve but are still leaking small amounts of water. These require fixed connections.

44. The new main chilled water pipe work between the chillers and internal plant room has been installed through two doors, thus rendering them as a fixed leaf.

45. The generator-set heat rejection radiator was inspected in the plenum above the redundant cooling towers and appears to be original and in poor condition. There is significant rust on all components and the probability of failure will increase over time.

46. The chilled water fan coil unit conditioning the generator room is original but appears to be in reasonable condition and operation. This could be retained, however given the FCU is approaching 30 years old, replacing this in conjunction with the rest of the mechanical

plant would be advantageous as the fan coil unit will be approaching its end of life in coming years.

47. The UPS cooling system incorporates two chilled water fan coil units. Water currently leaks from the valve set and onto the UPS below. Drip trays have been retrofitted under floor penetrations but require further work.

48. The Technical Equipment Room is served by three chilled water Computer Room Air-Conditioning (CRAC) units with a common high level supply duct and return air through the front of each unit. There is an over-temperature alarm with dial out, which currently operates satisfactorily.

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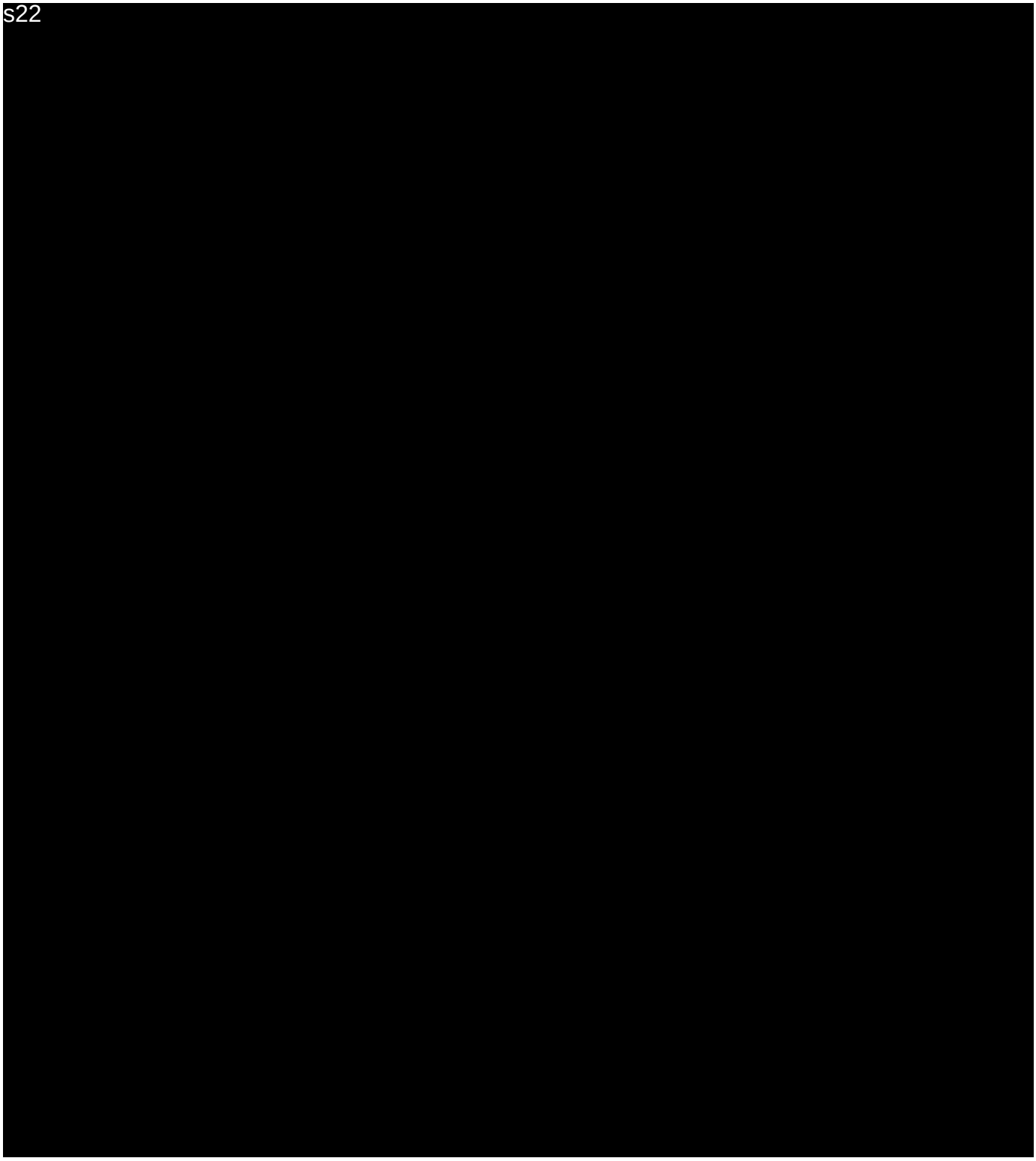

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Requirement 1.3.4 Fixed Communications Facility

56. **Overview.** The Fixed Communications Facility (FCF s33 [redacted]. The FCF consists of an array of antennae masts, with the plant and ICT equipment which sustains the FCF located in a hardened underground bunker.

57. **Current State - Architectural.** The existing facility is in reasonable condition however the site inspection identified a number of safety risks, including:

a. The configuration of the goods access lift is dangerous and needs improvements to handrails and the like to prevent an operator from unintentionally falling from height.

b. The egress from the underground computer room is via the adjacent plant room. The egress widths within the plant room are too narrow, well less than the required meter.

c. There is only one egress point in and out of building, with a significant travel distance.

d. The lack of a membrane or sufficient vegetation cover on the earth covered mound causes water and sediment runoff into the building creating a slip hazard.

e. The egress stair handrails do not comply with the National Construction Code. The egress stairs lack the yellow nosings and infills to risers necessary to comply with National Construction Code.

f. The tunnel corridor is subject to flooding. The "Sump Pump 2" drainage pit is within the egress corridor and requires relocation as there is a risk of tripping on the grate in its current location. It should also be relocated to the lowest point of the floor (which is not currently the case).

g. Fuel storage (1x 44 gallon drum of diesel) is located in the egress path. This is a significant safety issues as flammable substances (particularly in such quantities) should not be stored in what is the only egress path from the facility.

h. The vault door hardware is damaged with possibility of locking personnel in the plant room, which is a safety issue. In addition, the vault door hardware does not comply with egress door hardware requirements.

i. There is evidence of concrete cracking in the tunnel which should be repaired before it becomes a trip hazard.

j. There is evidence of driving rain entering into the building via the double doors. This creates a slip hazard.

k. The access to the antenna array is compromised by existing natural ground conditions. Current access is by scissor-lift, and a more stable footing is required for the scissor-lift to safely traffic around the site. Alternatively, the masts need to be changed out for hinged masts so that maintenance can be undertaken at ground level.

l. Stakeholders advised issues with the earthing system to the 30 antennas, where it cannot be confirmed if there is an earthing mat. Recent 10 ohm tests have failed and can only pass when significant volumes of water are discharged in the area. The existing earth mats do not provided sufficient resistance and earthing cabling connections to antenna array are exposed.

58. **Current State - Mechanical.** The main room is air-conditioned by two 20 kW air-cooled ducted packaged units that operate on R22 refrigerant and were installed in 1996. They are currently planned to be replaced at a cost of $94,000. The premium is due to relocating the UPS battery bank, which is required to provide access to the packaged units.

59. The battery ventilation appears to not comply with *AS2676 Installation and Maintenance of Batteries in Buildings*, which requires the extraction system to draw air from the topmost point of the bank.

60. s33 [redacted]

61. The main equipment room power supply is fed from a single distribution board. This potentially creates supply continuity issues when maintaining the distribution board, as disabling power to all equipment.

62. The sumps are designed to capture diesel spillages. On inspection of the sump line discharge above ground, there are safety systems in place (for example flame trap) to manage the risk of fire from diesel.

63. **Current State - Fire.** The plant and communications room includes both a VESDA system and gas suppression system. The gas for the suppression system is stored within the plant room, immediately adjacent the bank of batteries in the UPS. The configuration of the

fire system requires review by a fire engineer to check compliance against current codes and to ensure that the configuration does not pose unnecessary safety risks for the personnel working in the communications room.

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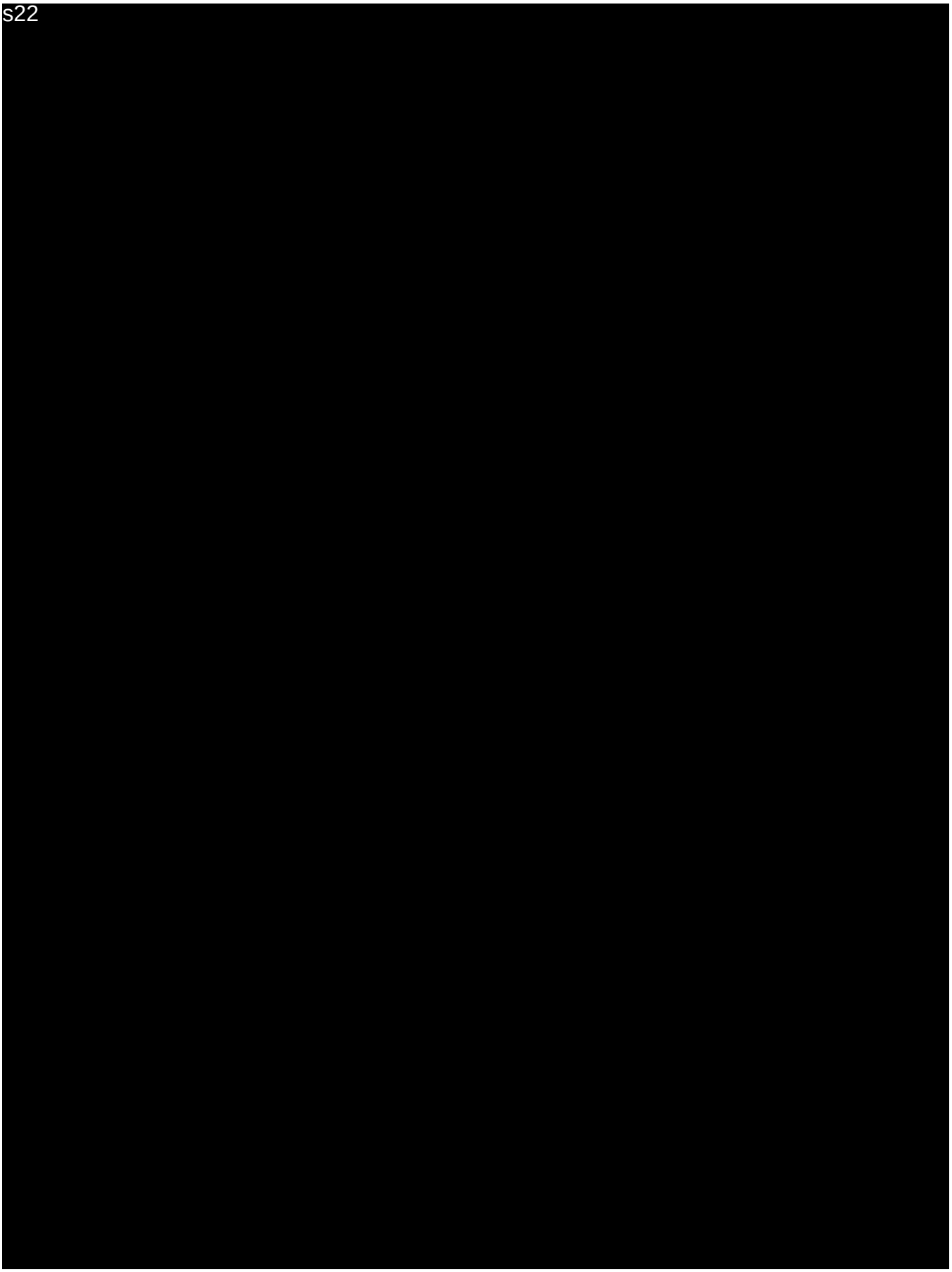

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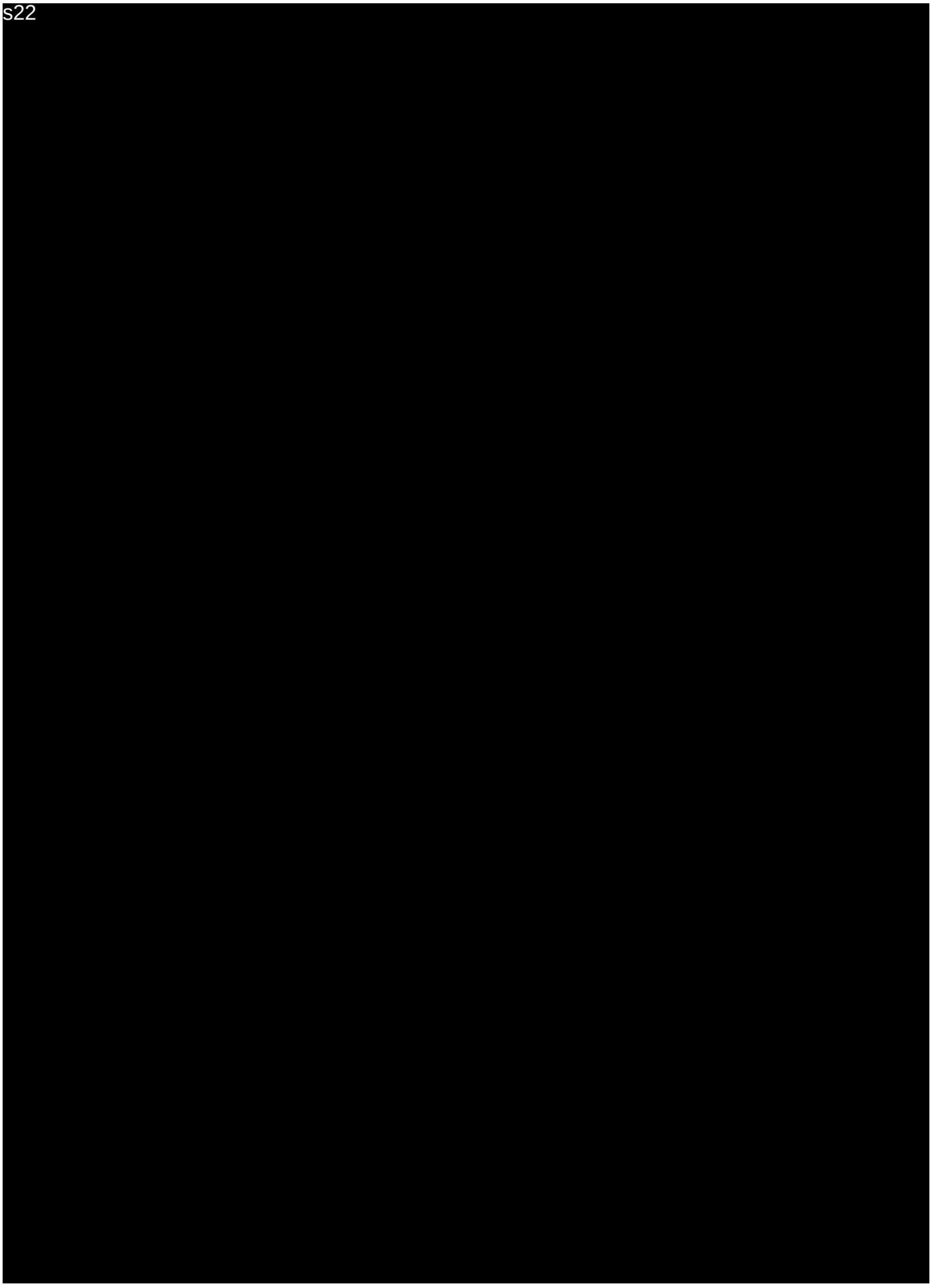

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Requirement 1.6.7 Maritime Technical (Building 1018)

103. **Overview.** The Maritime Technical building is a hardened bunker facilit s33 [redacted]

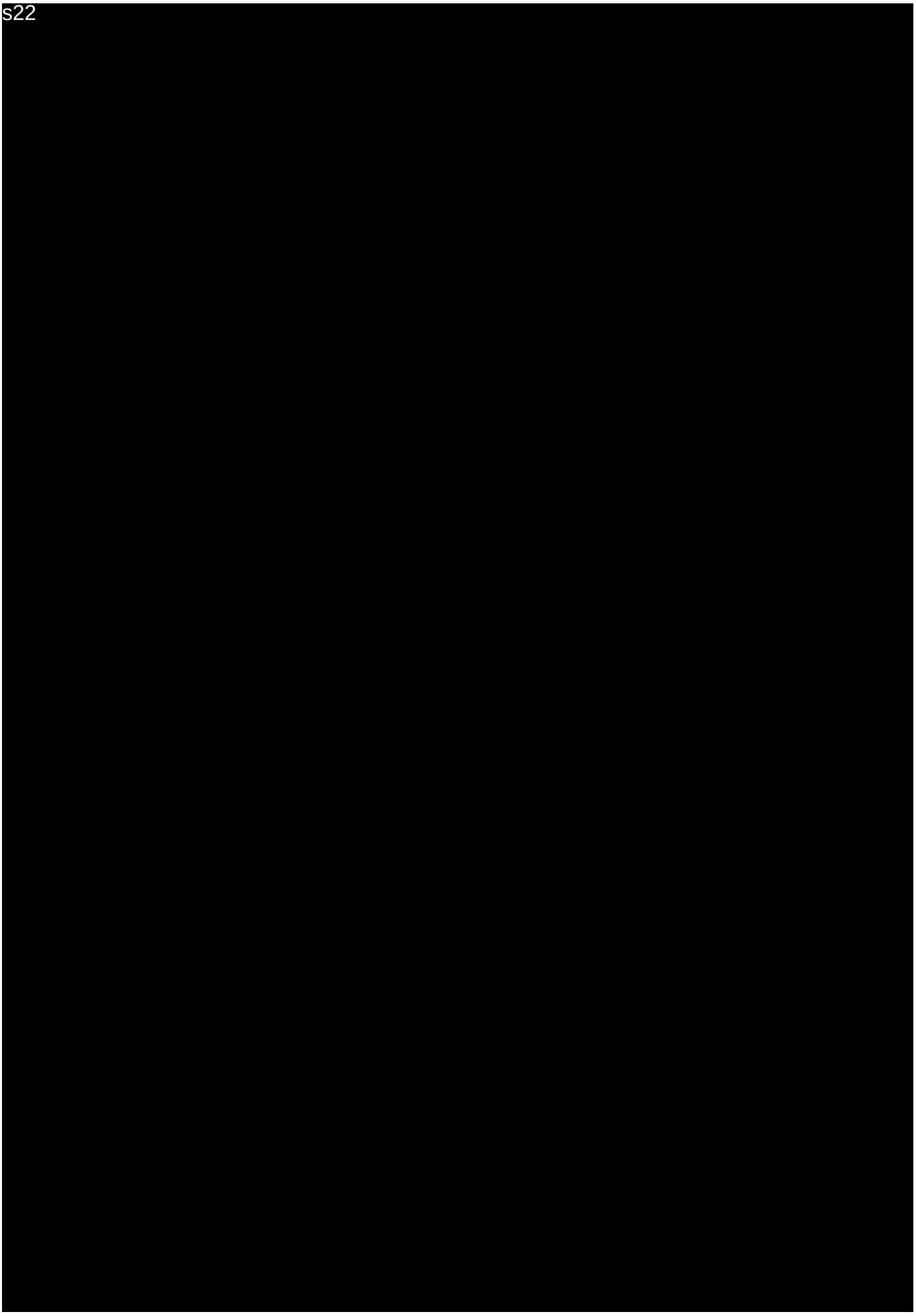
104. **Current State - Mechanical**. The main air conditioning is provided by one 56 kW air-cooled DX ducted split system installed in 1998 and operating on R22 refrigerant. Return air is via the ceiling space and filtered at the fan coil unit. The existing air conditioning system is in poor condition and existing R22 refrigerant will become cost prohibitive to maintain.

Requirement 1.6.8 Maritime Operations (Building 1019)

105. **Overview.** The Maritime Operations building is a hardened bunker facility s33 [redacted].

106. **Current State - Mechanical.** The main air conditioning is provided by one 65 kW air-cooled DX ducted split system installed in 1998 and operating on R22 refrigerant. Return air is via the ceiling space and filtered at the fan coil unit. The existing air conditioning system is in poor condition and existing R22 refrigerant will become cost prohibitive to maintain.

107. **Current State - Architectural.** At the time of inspection, the entry path was flooded and the doors were difficult to open due to the build-up of silt. The presence of silt was also evident inside with the majority of carpet stained from mud tracked from outside.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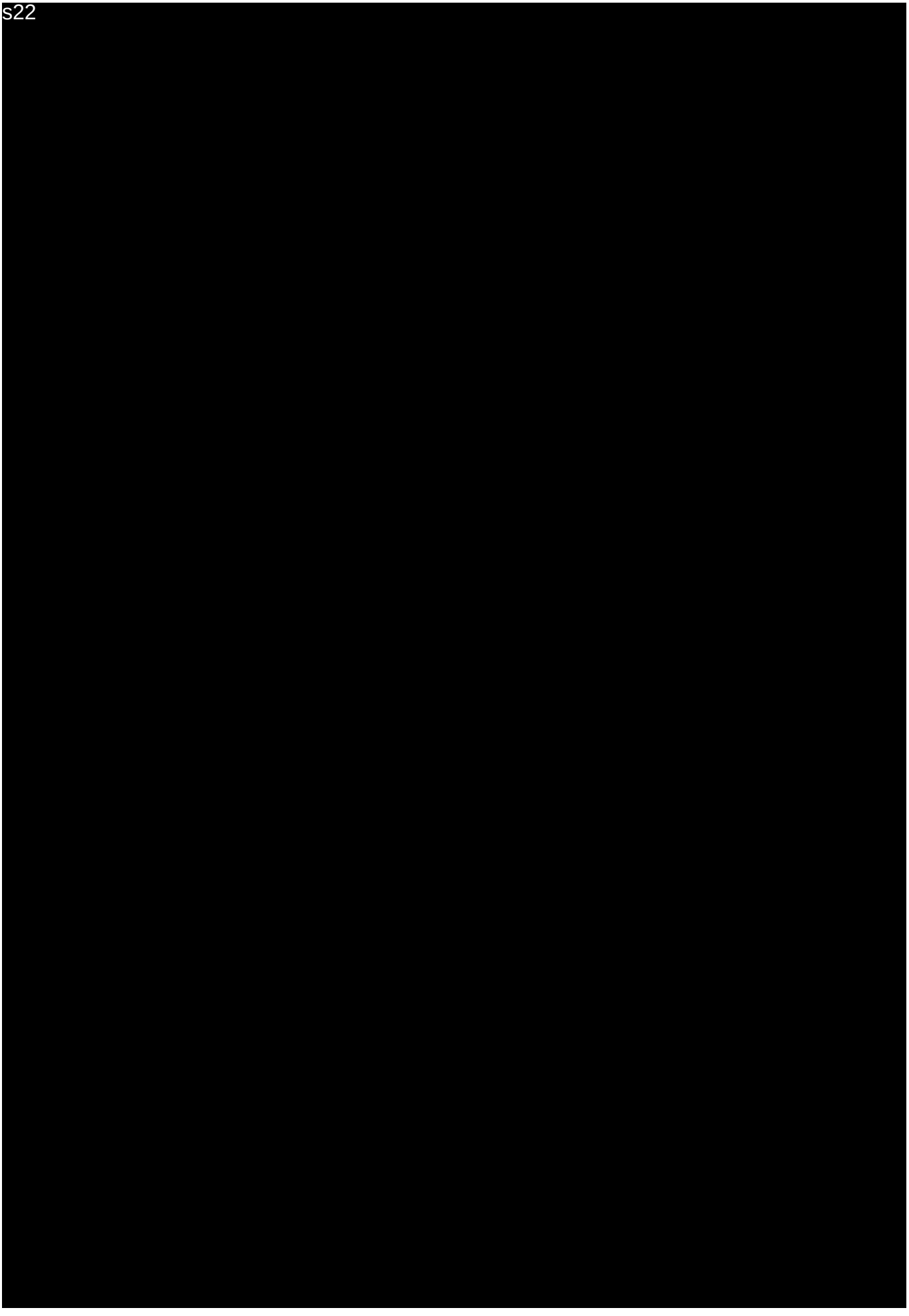
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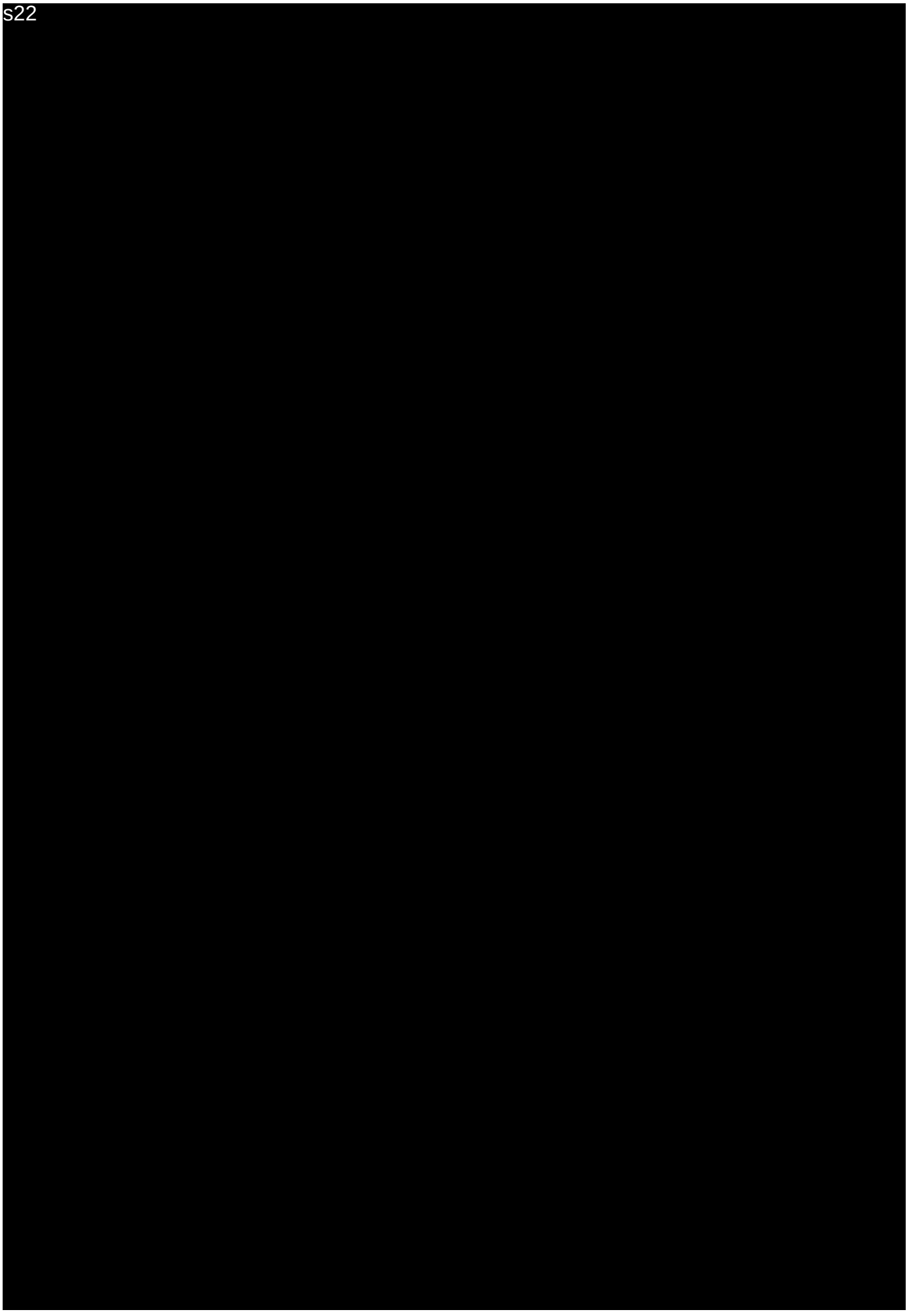
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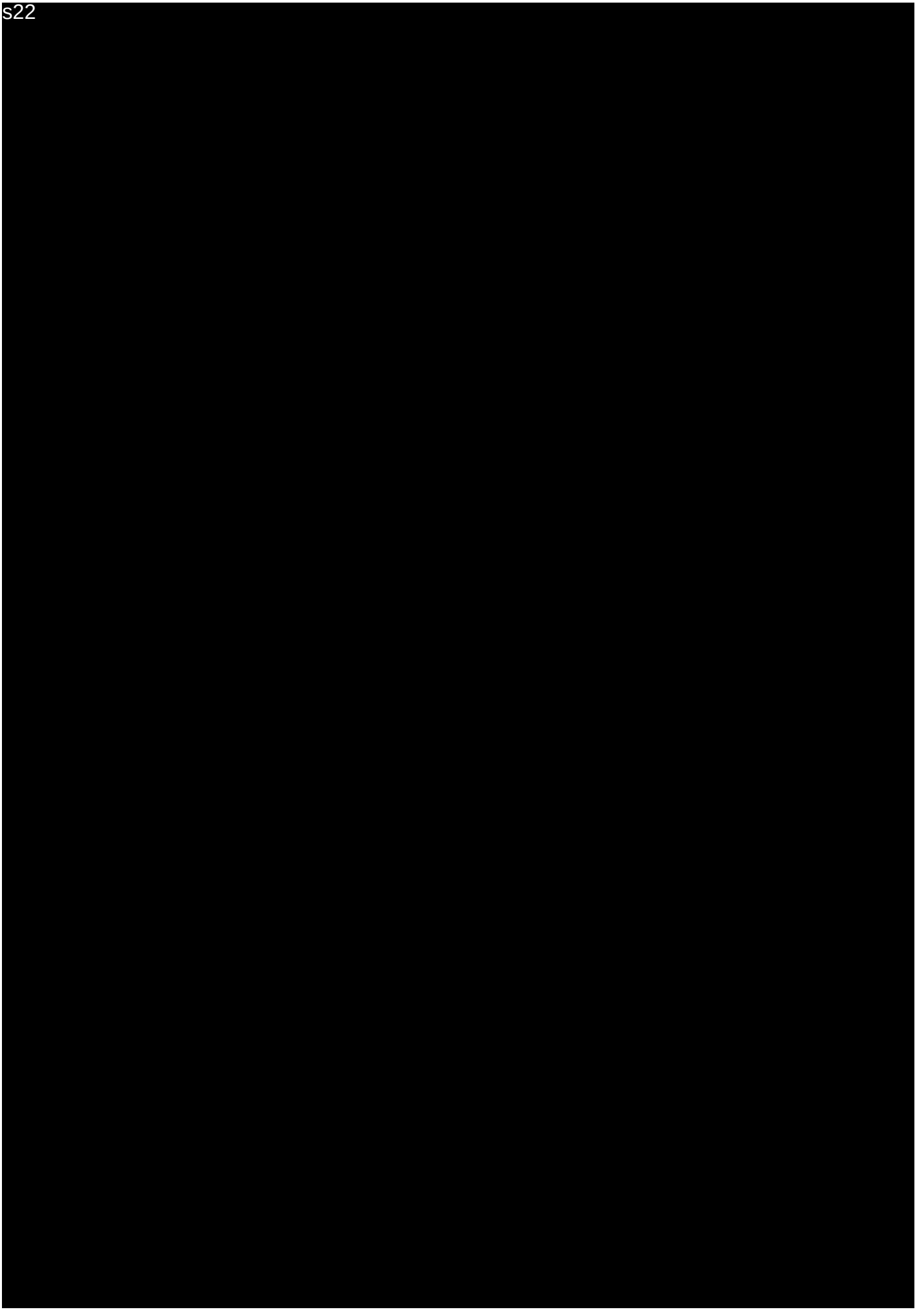

Requirement 1.17 Earth Covered Buildings

143. **Overview.** There are numerous earth covered buildings at RAAF Base Tindal which are designed as hardened facilities for purposes such as accommodation, offices and operational support facilities. These buildings (Building numbers 1018, 1019, 420, 349 and 452) are characterised by a low earth mound exterior with the majority of functional space below ground, a single portal for access and no windows.

144. **Current State.** The exposed earth exteriors of all of the buildings inspected are experiencing some degree of erosion, due to the intense rainfall experienced during the wet season in Katherine from November to March. Compounding this problem is that during the dry season from April to October, little or no rainfall is experienced and as such vegetation does not grow which can mitigate erosion issues. The erosion issues are affecting the stability of the earth on the buildings, with significant displacement of sediment occurring at the base of the mounds. This is causing problems with access to some buildings, and is resulting in higher ongoing maintenance costs.

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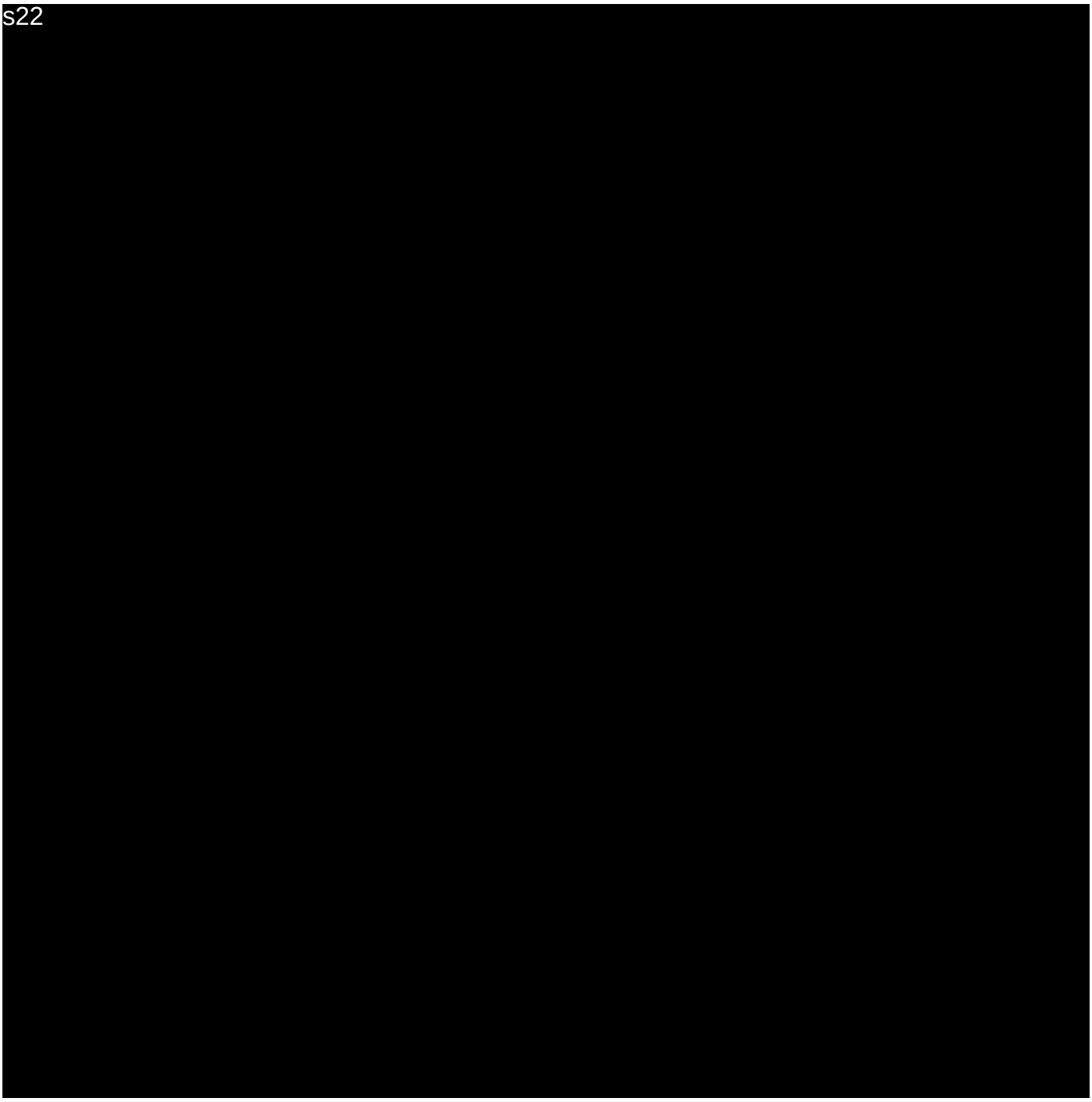

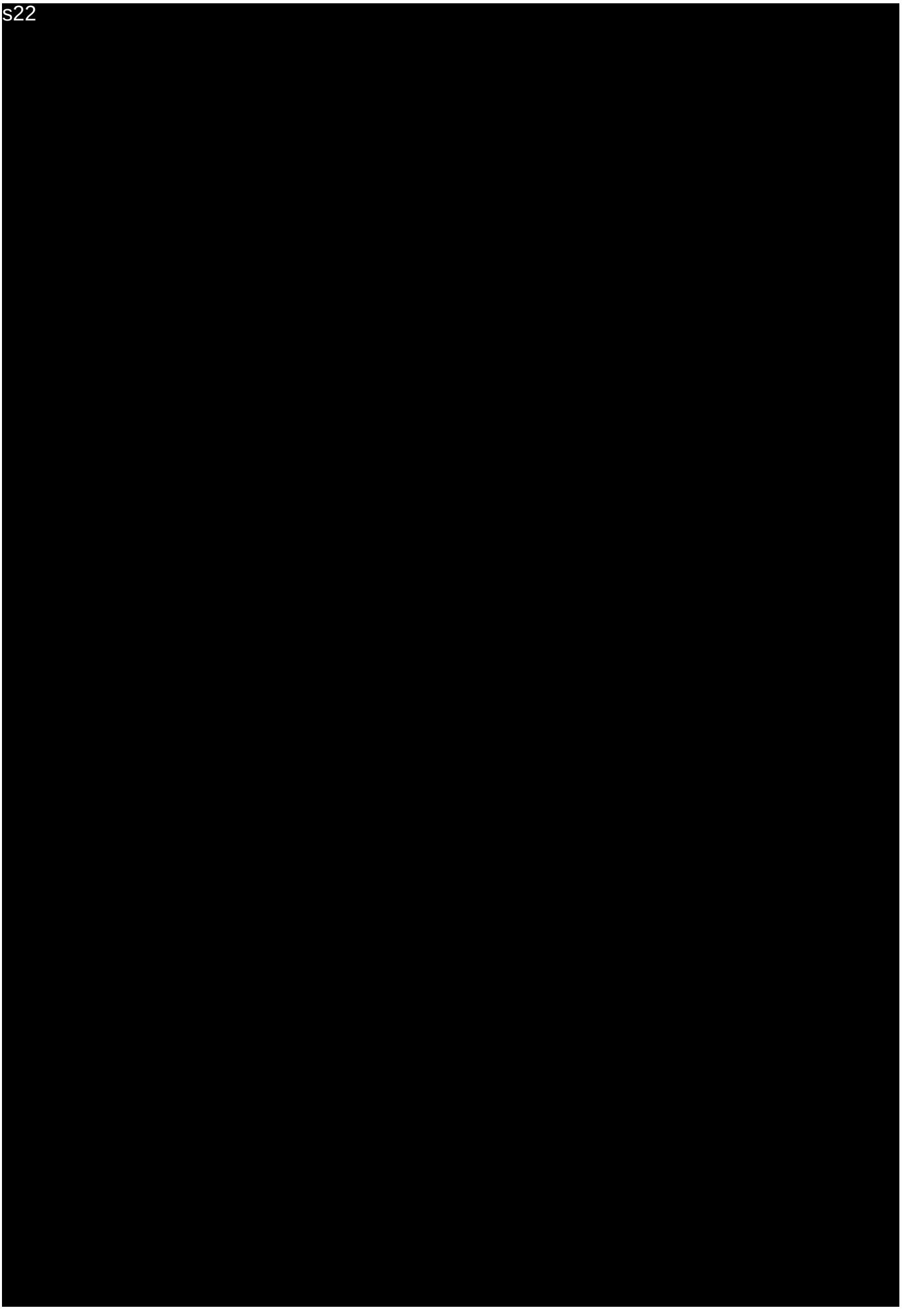
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Requirement 1.3 Northern Regional Operations Centre (NROC)

159. Options considered to address the NROC requirements included**:**

a. **Option 1 –** Do nothing. Maintain existing mechanical plant and architectural fixtures.

[7] E&I Group costs only. Doesn't make allowance for the cost of utilising existing RAAF staff and equipment to flush the lines, as is currently the case. No net increase in costs foreseen.

b. **Option 2 –** Undertake the following works:

(i) Requirement 1.3.1 NROC Building 452 - Retain chillers and upgrade existing internal mechanical systems. Undertake architectural upgrades.

(ii) Requirement 1.3.2 3 CRU Headquarters Building 450 - Like for like replacement of mechanical plant. Undertake minor architectural refurbishments.

(iii) Requirement 1.3.4 Fixed Communications Facility - Upgrade existing below ground plant room and safety upgrades.

(iv) Requirement 1.3.3 Link 11 Antenna Array and Shed (Building 1096) - Like for like mechanical repairs, undertake electrical upgrades.

(v) Requirement 1.3.5 3CRU Antenna Tower - Demolish existing tower and construct new tower to comply with AS 1657.

(vi) Requirement 1.3.6 3CRU Store Building 454 - Demolish existing facility and remediate site. Construct new storage facility on base.

160. Options to construct a NROC precinct-wide cooling system, servicing all buildings in the NROC compound was considered. However, it was deemed that this would not be a viable option compared to the standalone cooling arrangements in place presently, as the benefits of this 'campus' approach would not outweigh the significant capital construction costs for a precinct-wide cooling system.

161. Offsite storage at a commercial facility to replace the 3CRU warehouse was not considered a suitable option. s33 [redacted] Furthermore, co-locating the warehouse close to the existing 3CRU compound is important for operational efficiency.

162. The estimated cost of each option is set out in the table below.

Option	Capital Construction Estimate	Annual Building Operating Costs	Whole Of Life (WOL) over 30 years		
			2.5%	3.7%	6.0%
1	Nil	$0.529	$22.816	$18.829	$13.074
2	$12.694	$0.129	-$3.027	-$1.088	$1.466

Table 8: Northern Regional Operations Centre, cost comparison summary

163. **Option 2** is the preferred option for the Northern Regional Operations Centre for the following reasons:

a. The mechanical plant in the 3CRU Headquarters building is at the end of life, and as such is no longer performing at the required specification, which is adversely impacting the habitability of the building.

b. s33 [redacted]

c. The existing external chillers are relatively new, are in good condition at present and do not require replacement in the near future.

d. The current 3CRU Store is at the end of life, and is no longer fit for purpose to store the high value equipment it contains.

e. The safety issues at the Fixed Communications Facility are a real risk to personnel safety and require remediation.

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(v) Requirement 1.6.7 Maritime Technical (Building 1018). Like for like replacement. Replace the existing air-cooled DX unit with current technology systems.

(vi) Requirement 1.6.8 Maritime Operations (Building 1019). Like for like replacement. Replace the existing air-cooled DX unit with current technology systems

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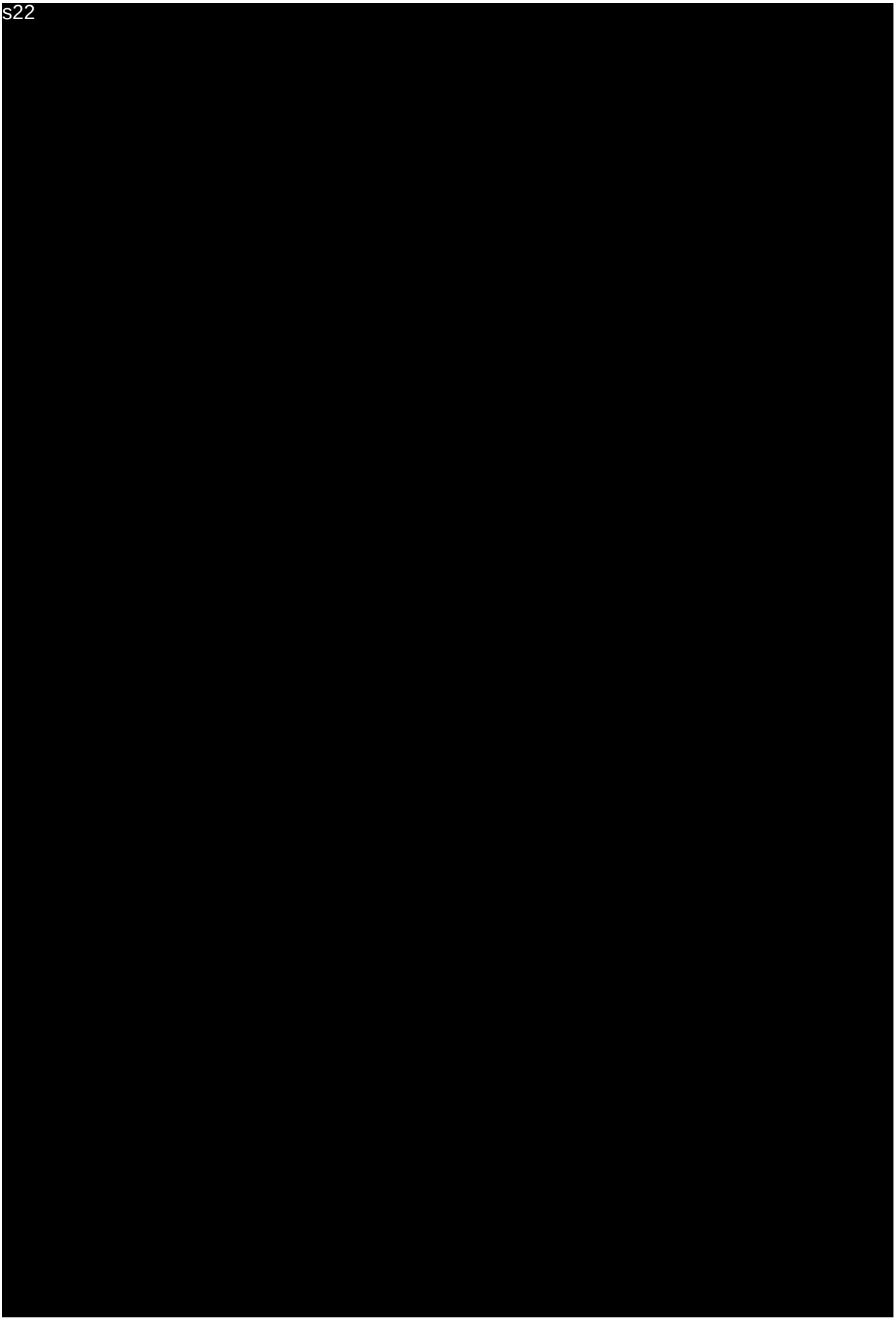
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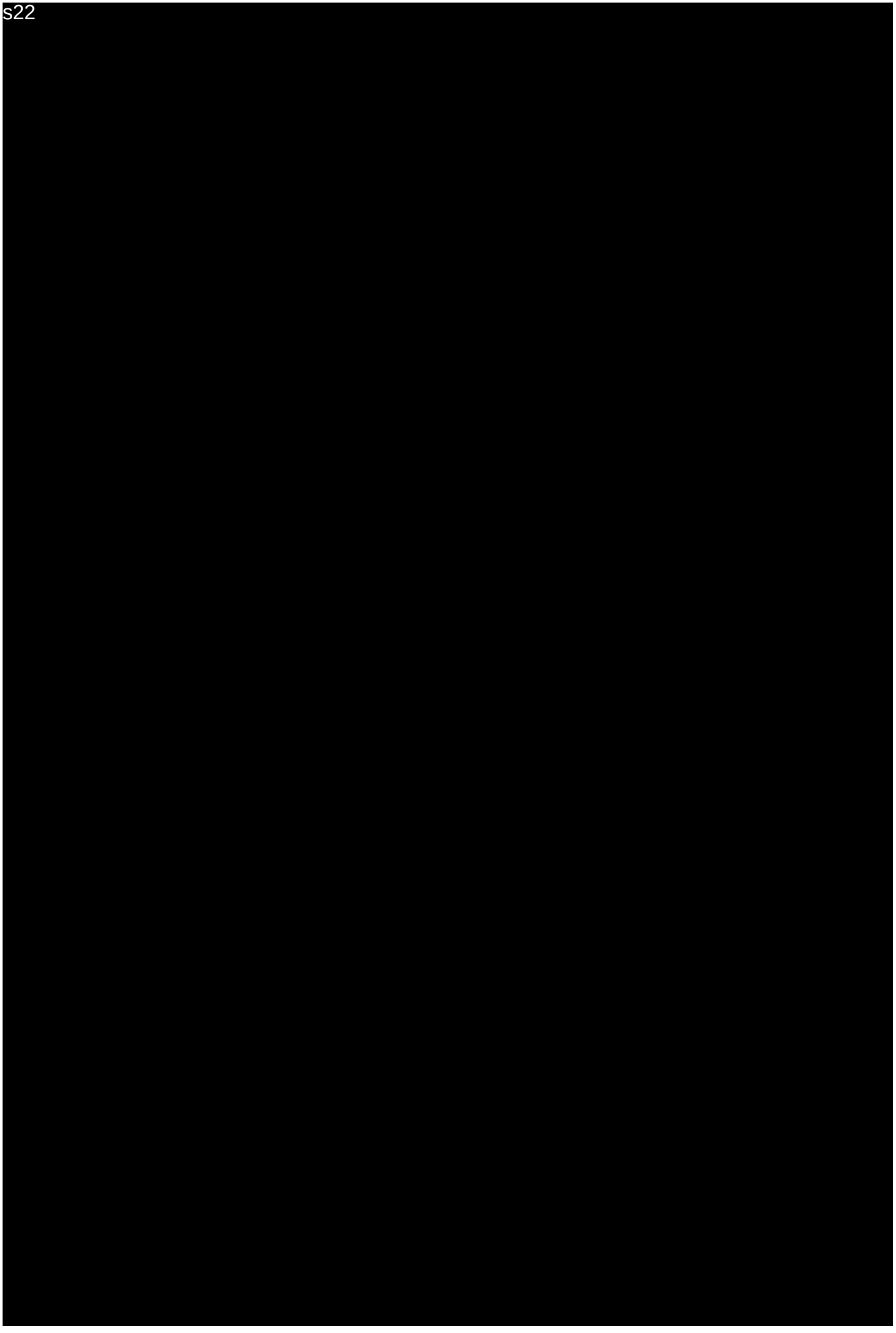

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Project Element	Option 1 – High Priority Only	Option 2 – High & Medium Priority	Option 3 – Full Scope
	$m	$m	$m
Northern Regional Operations Centre	5.550	5.550	5.550
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Earth Covered Buildings	0.000	0.000	1.125
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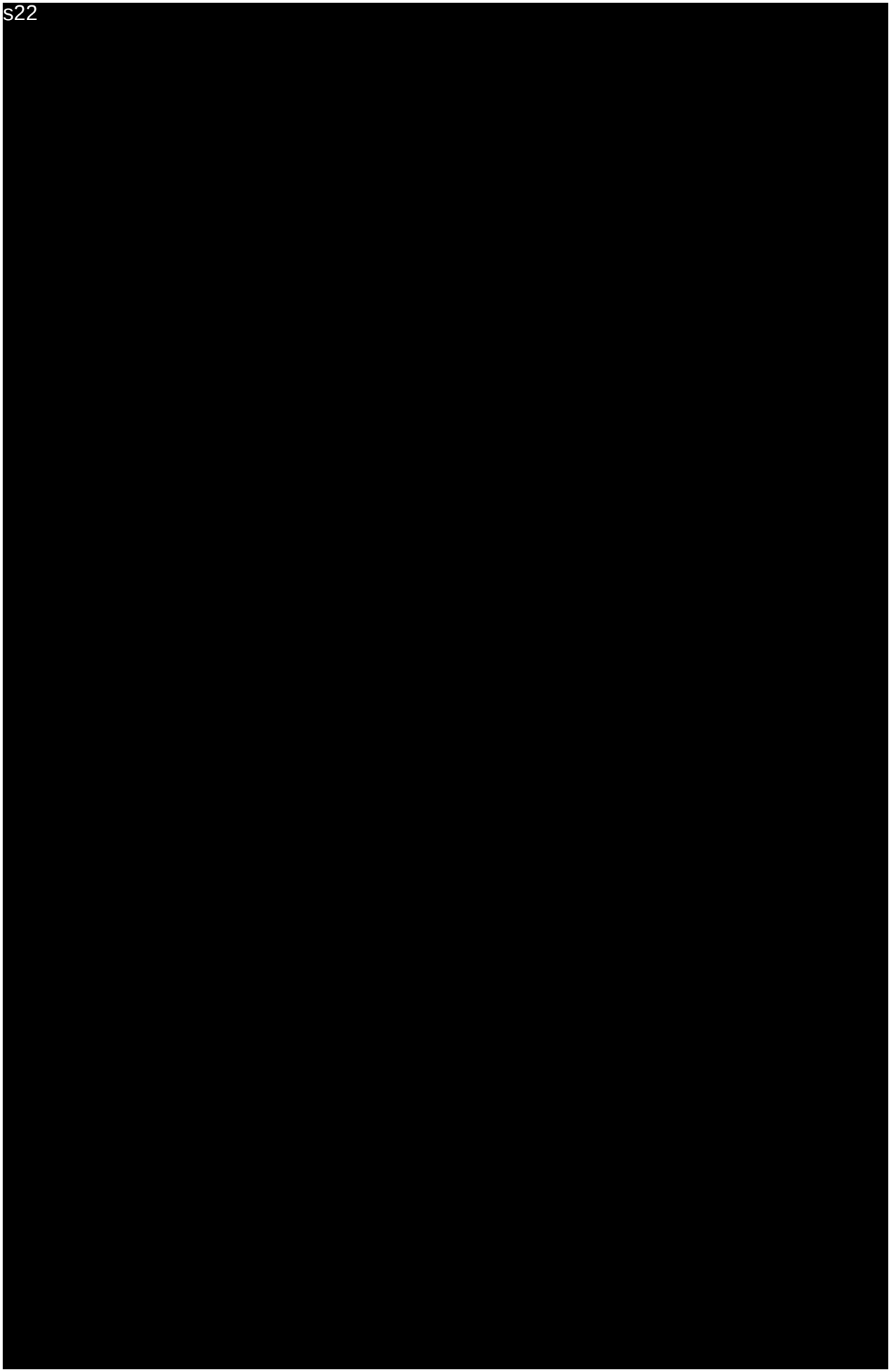
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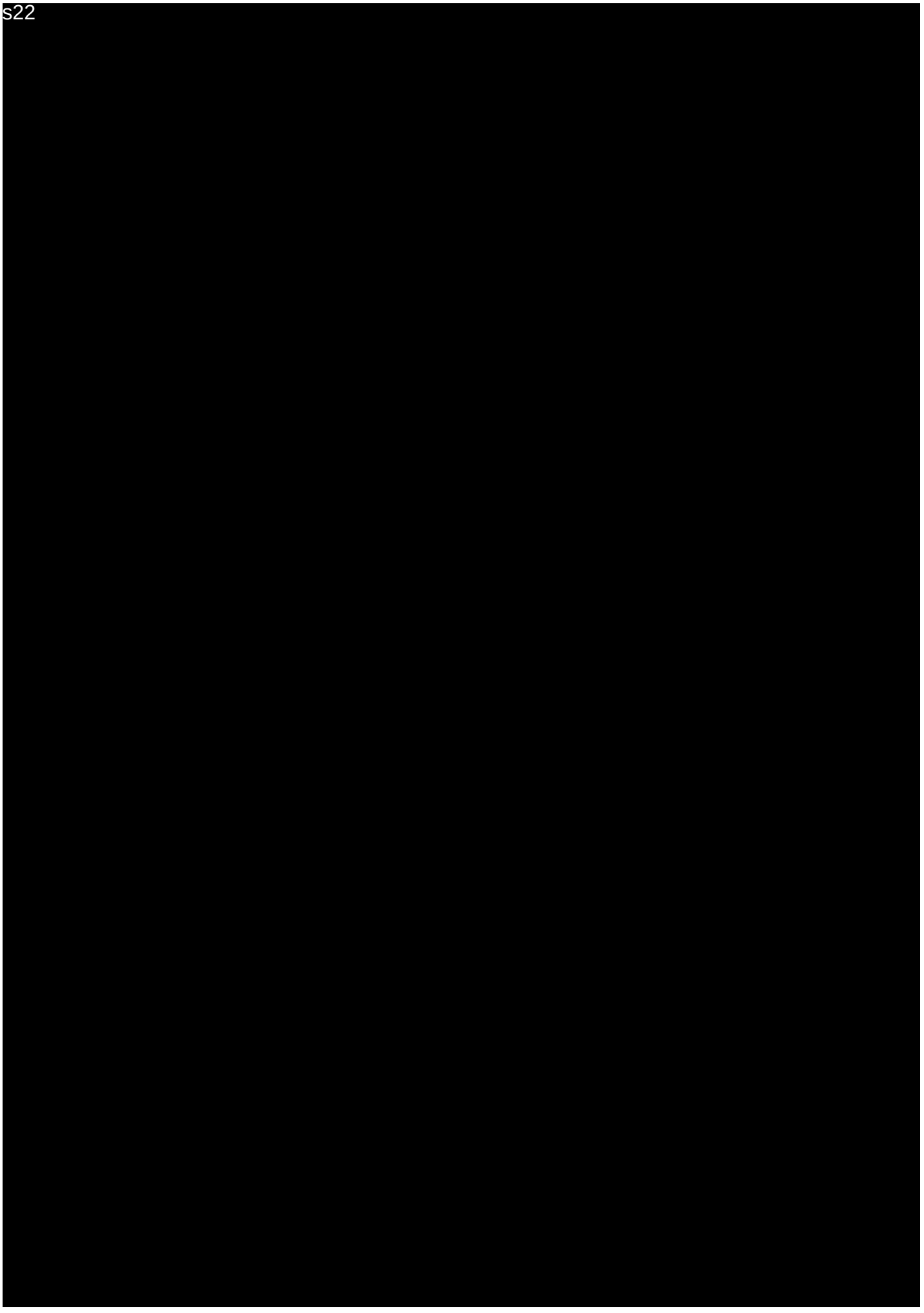

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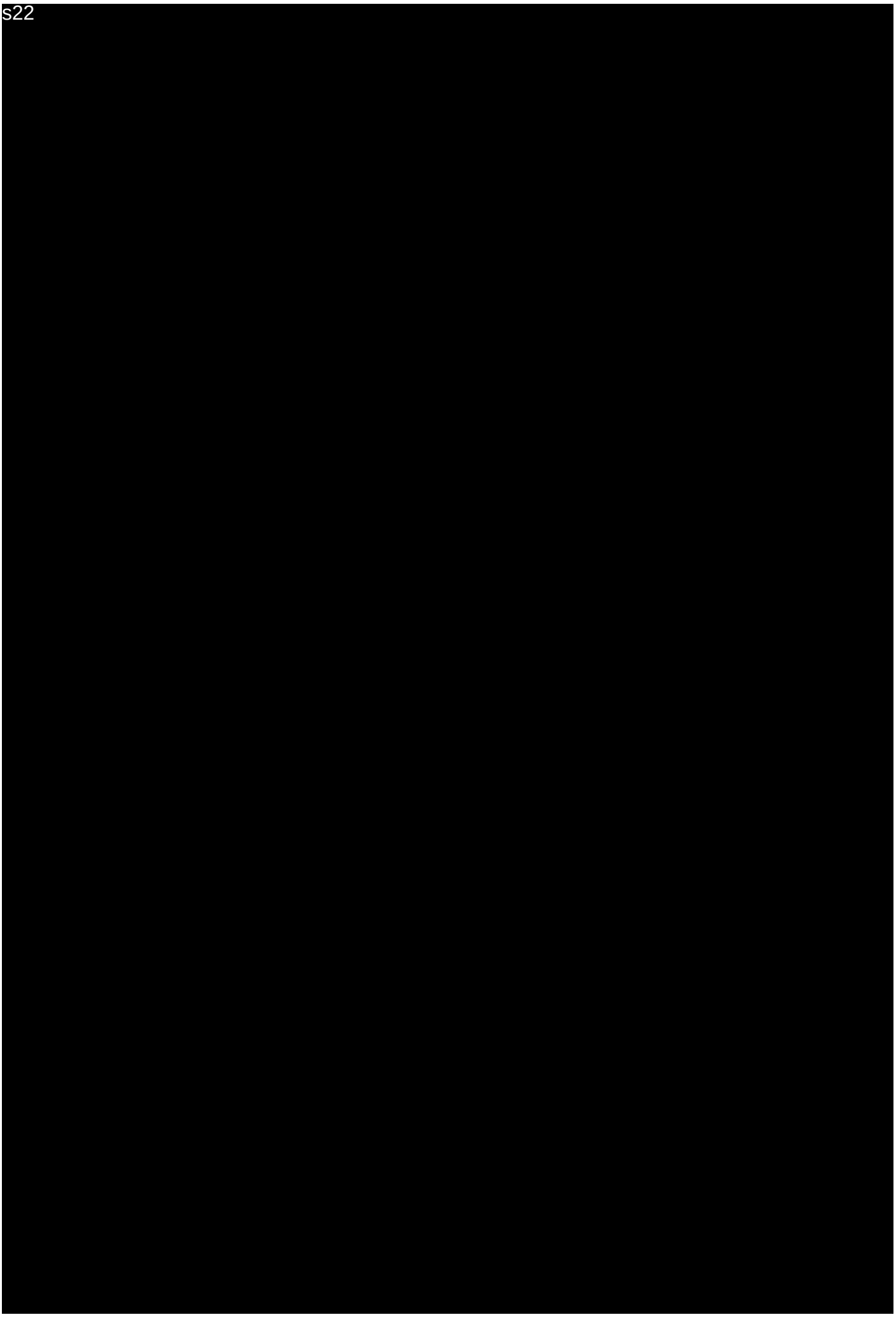

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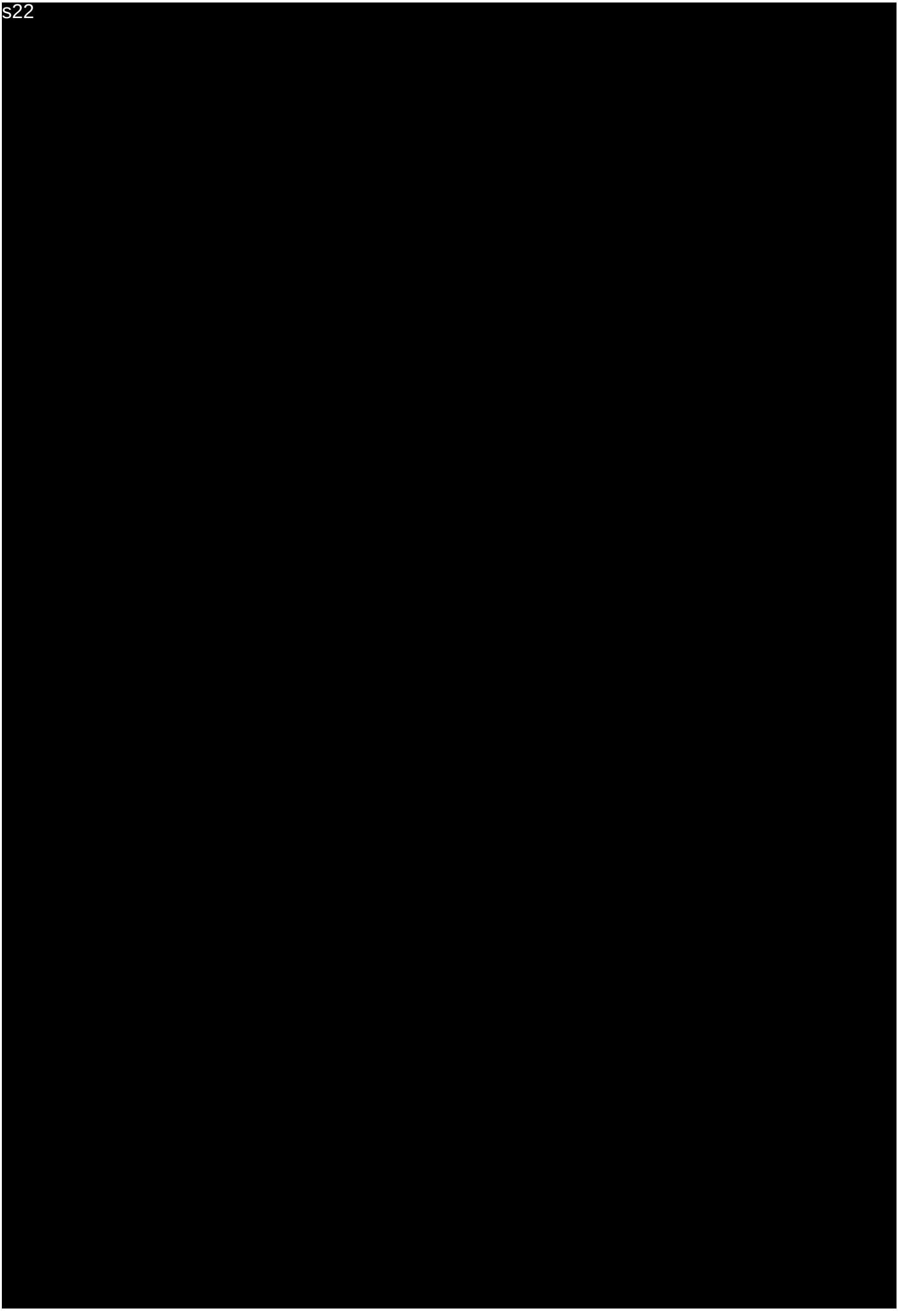

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Project element	Attribute
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Northern Regional Operations Centre (NROC)	• Established market of experienced subcontractors • No requirement to site new buildings • Relatively low-cost project element • Limited interaction with other contractors, clearly defined boundaries • Likely to involve significant refurbishment elements – difficult to price without initial design work • Difficult staging requirements – would benefit from early contractor involvement • Need for significant user consultation and planning to avoid disruption
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Project element	Attribute
s22	[redacted]
Earth Covered Bunkers	• Specialist Defence Requirement and performance standards • Limited market of experienced subcontractors • Geotechnical and site investigations are incomplete • Limited interaction with other contractors, clearly defined boundaries and interface with the airfield • Specialist products and construction techniques required
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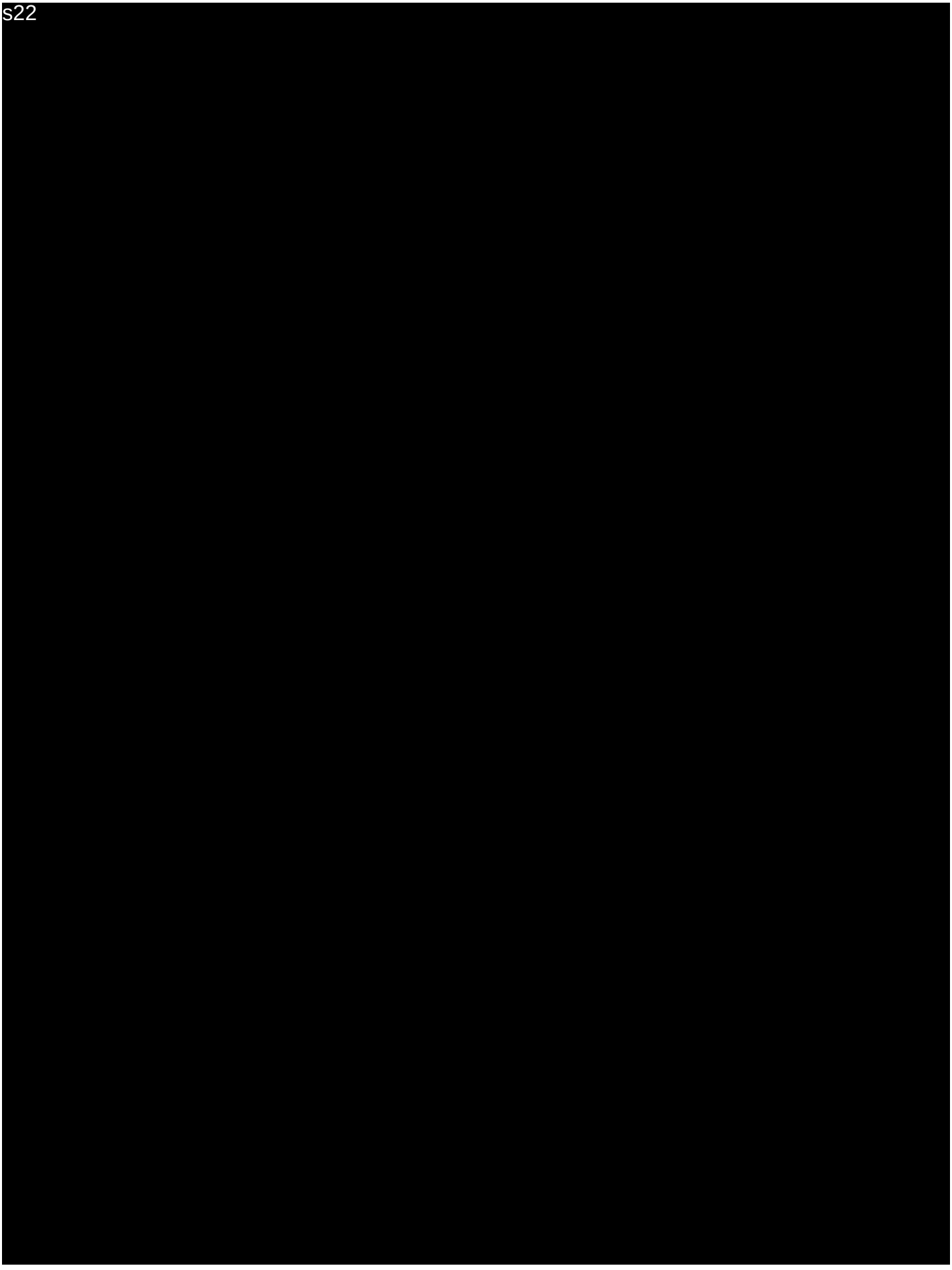
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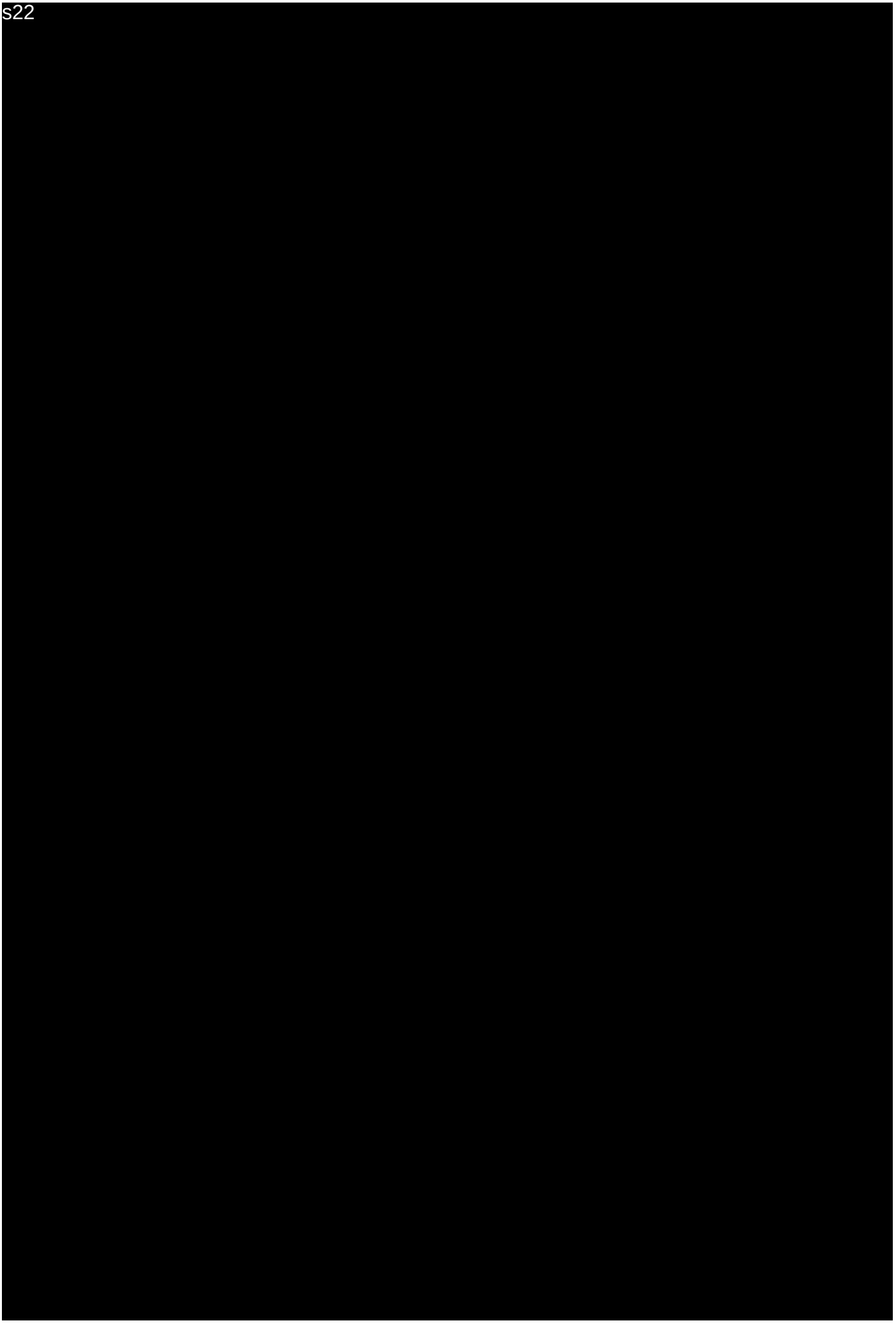

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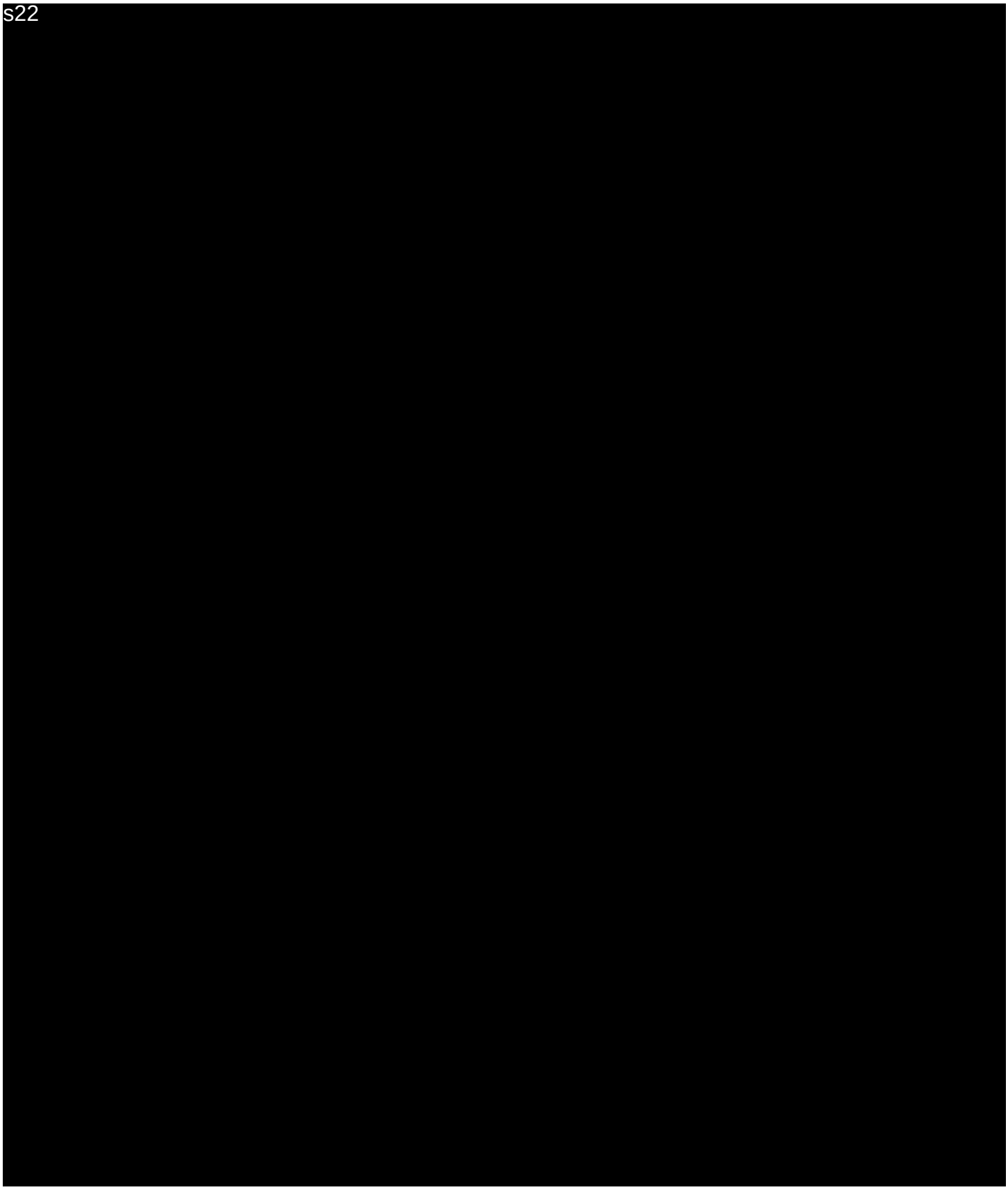

Northern Regional Operations Centre

Requirement

12. NROC s33 [redacted] The building must also remain occupied and operational with minimal downtime during any upgrade works designed to facilitate this requirement.

13. **Current State - Overall**. The original building and mechanical system was designed as a hardened facility with earth covering. The subsequent chiller replacement is external to the earth covered structure and does not provide hardening. s33 [redacted]

14. Overall Costs for all NROC components:

	Capital construction costs	**WOL Costs (3.7%)**
Option 1 Do nothing	Nil	$18.829
Option 2 Upgrade existing	$12.694	-$1.088

Options considered

Northern Regional Operations Centre (Building 452)

15. Details of options considered:

Option 1 – Do nothing	
Description:	
• Maintain existing mechanical plant and architectural fixtures	
Advantages	**Disadvantages**
• No construction cost • No disruption to operations	• Personnel discomfort from poor performing mechanical plant • Increased maintenance costs over time
Risks	**Opportunities**
• Increased presence of mould due to poor air circulation	• Nil

Option 2: Retain chillers and upgrade existing internal mechanical systems. Undertake architectural upgrades
Description:

- Retain existing external chillers in the current location. Replace the internal chilled water pipe work and fan coil units, including the main pipe work loop and valves. As a full building shutdown may not be feasible, a staged approach could be implemented. A new chilled water system would be installed before removing the existing loop.
- Reconfigure and upgrade existing ablutions to provide separate male and female ablutions.
- Inspected access floor and repair corrosion and removal mould where necessary.

Option 2: Retain chillers and upgrade existing internal mechanical systems. Undertake architectural upgrades

- Provide new non-slip stair treads compliant with NCC
- Architectural upgrade works associated with mechanical services upgrades including hardening of mechanical plant (if required)
- Replace existing damaged doors and door hardware
- General patch and painting to damaged walls and ceilings throughout
- Engage fire engineer to review fire rating of generator, associate fuel storage and associated batteries.

Advantages	Disadvantages
• Most inexpensive option to improve mechanical issues • Reuses existing plant • Architectural remediation relatively inexpensive	• Higher running costs than other options • Exterior chillers do not provide opportunity to harden facility in the future
Risks	**Opportunities**
• Works may disrupt NROC operations	• Nil

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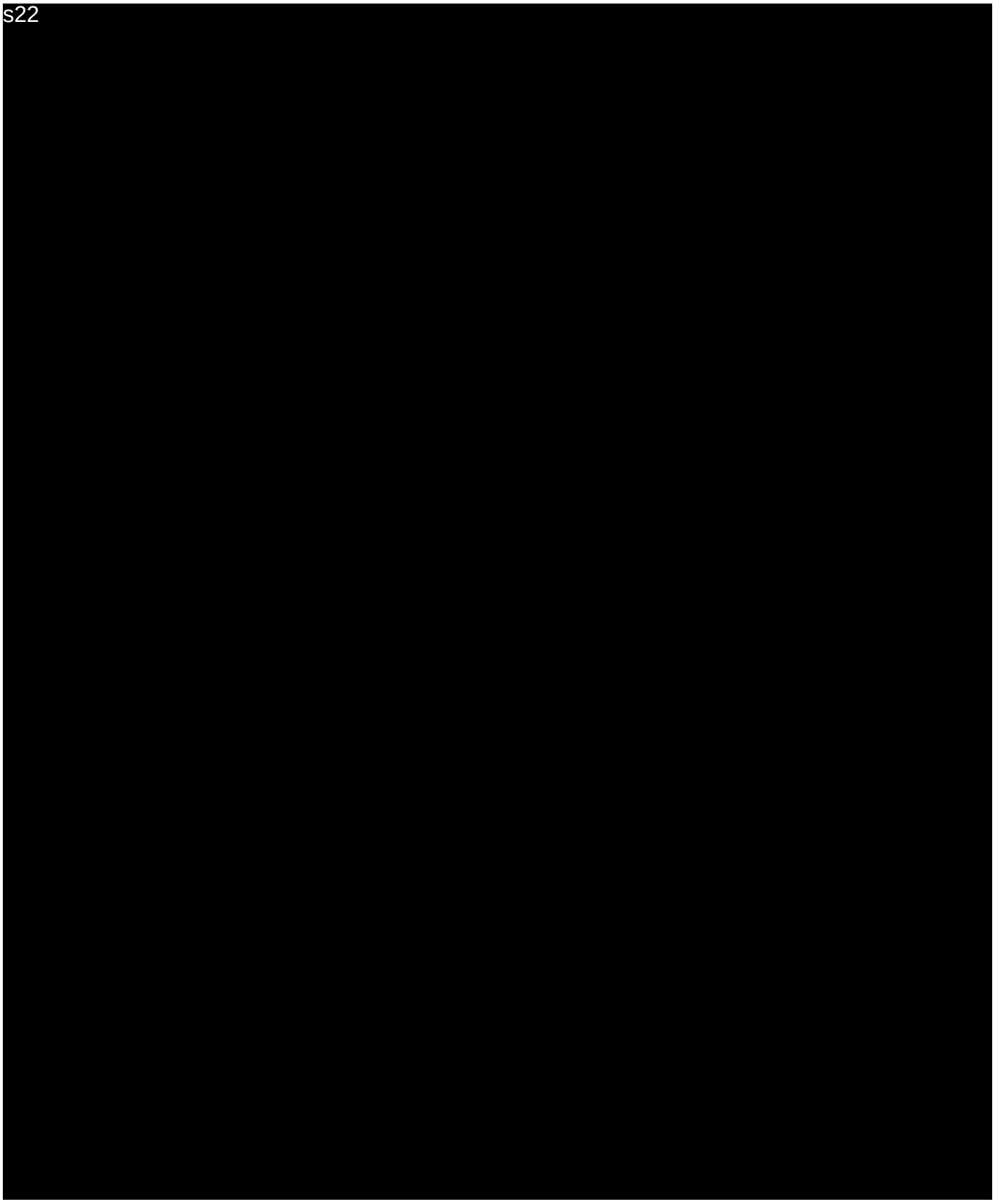
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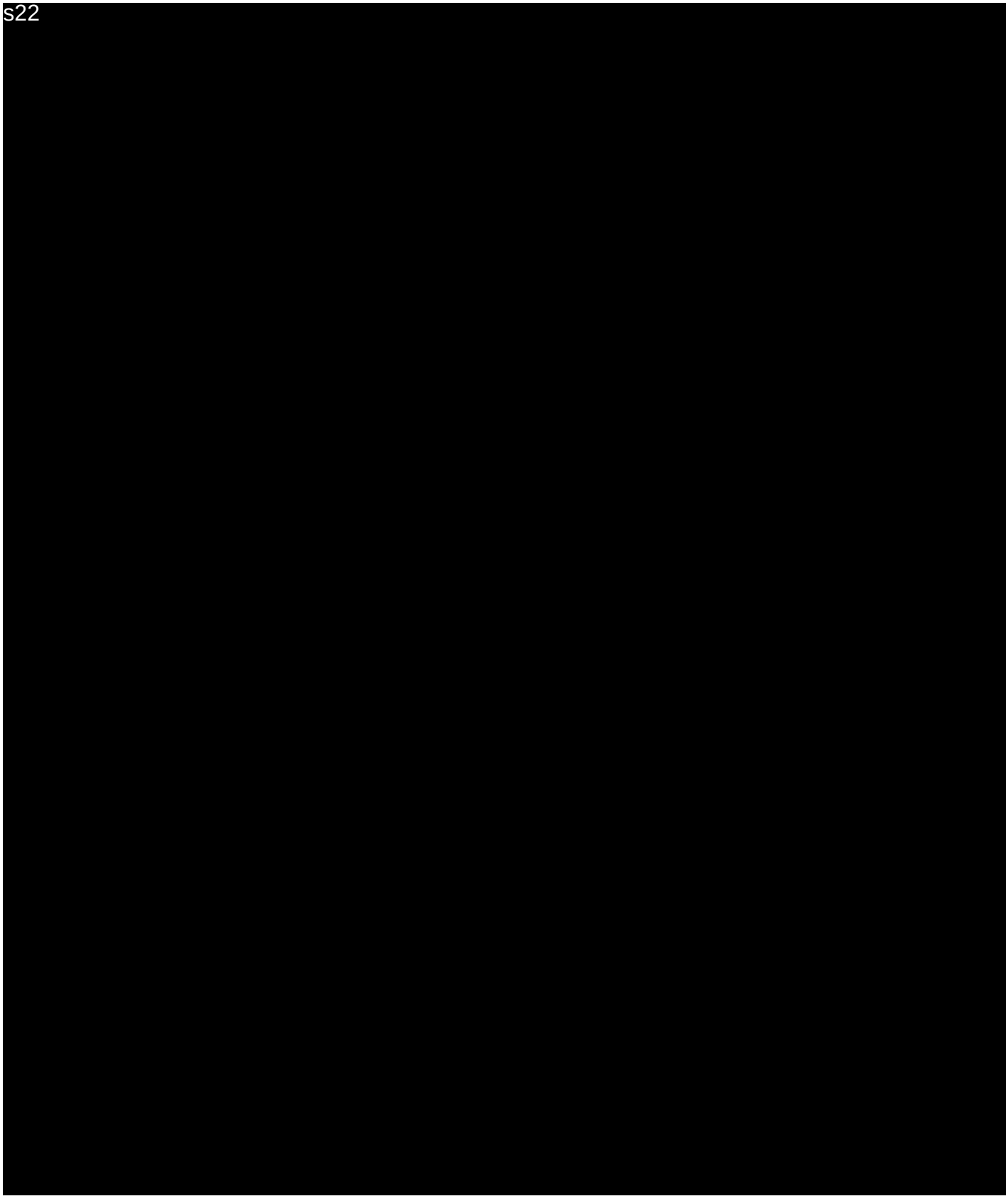
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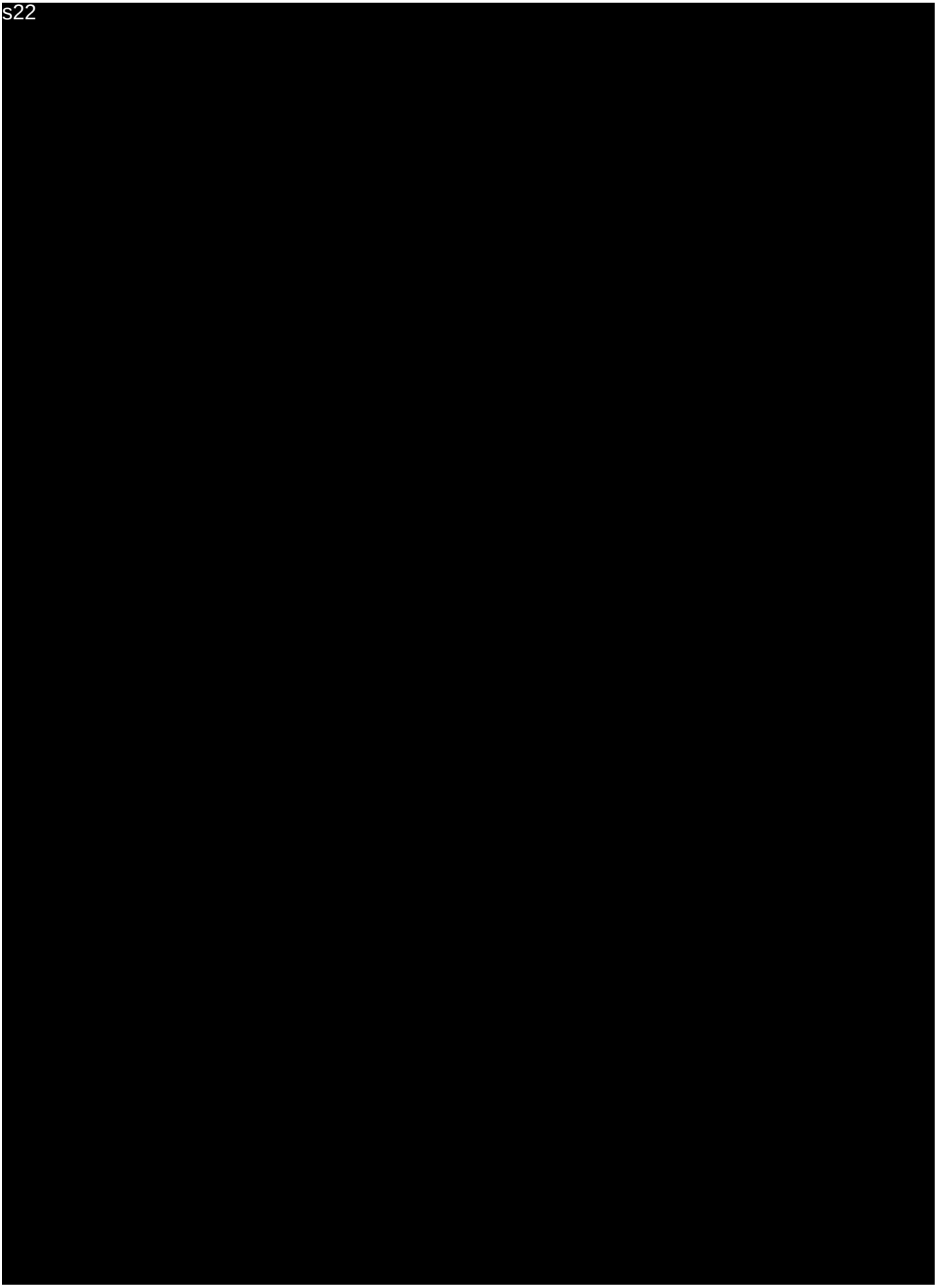

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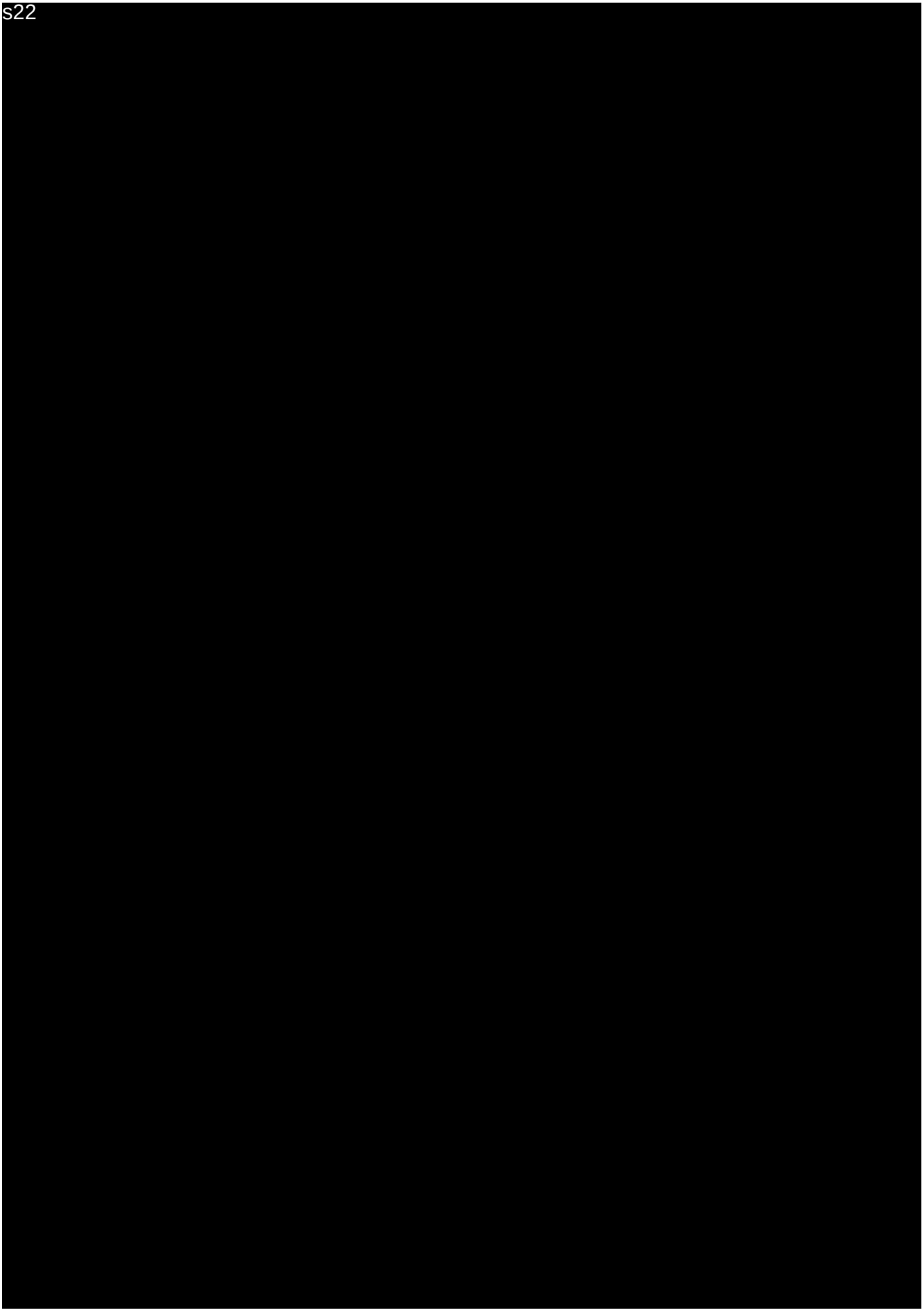

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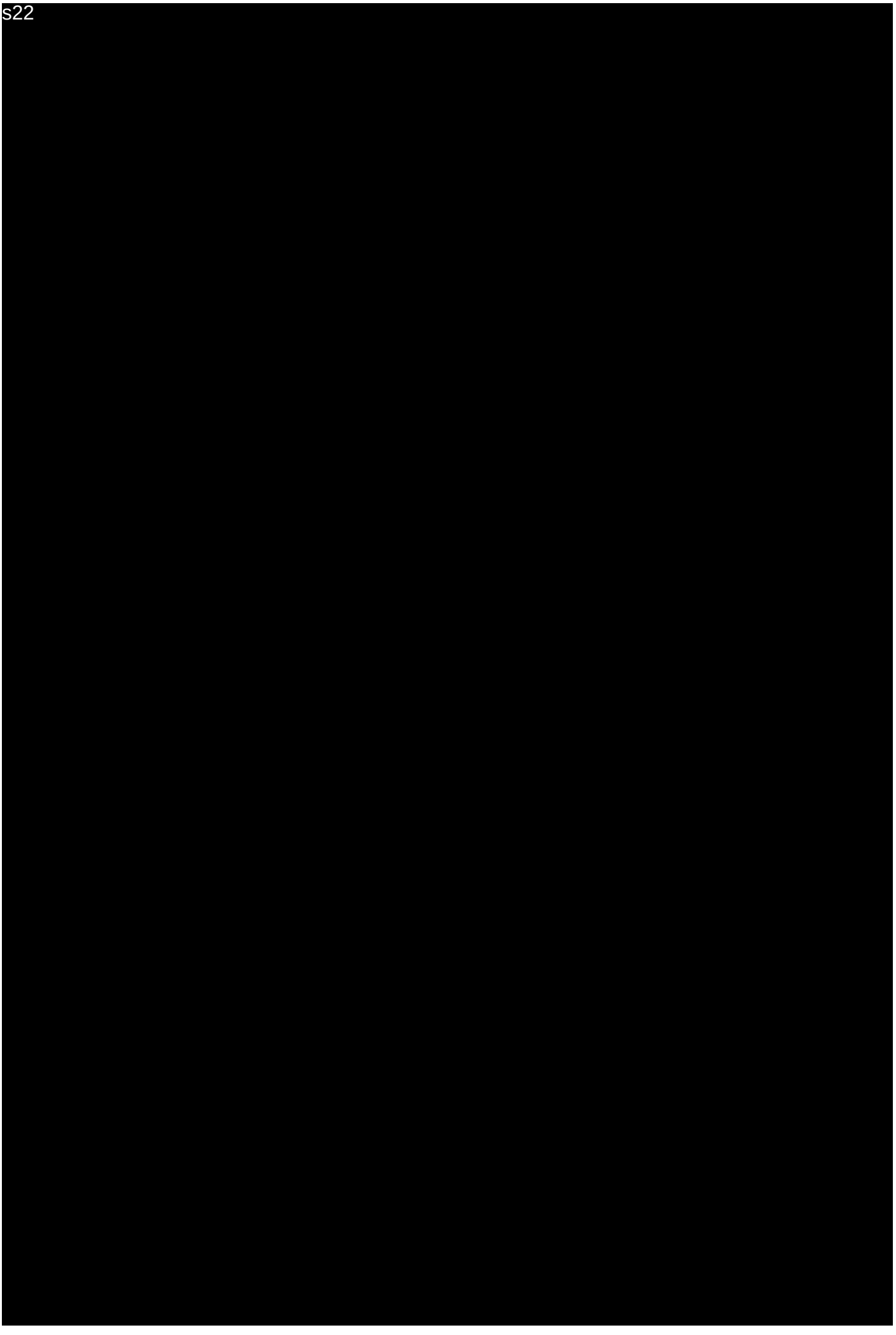

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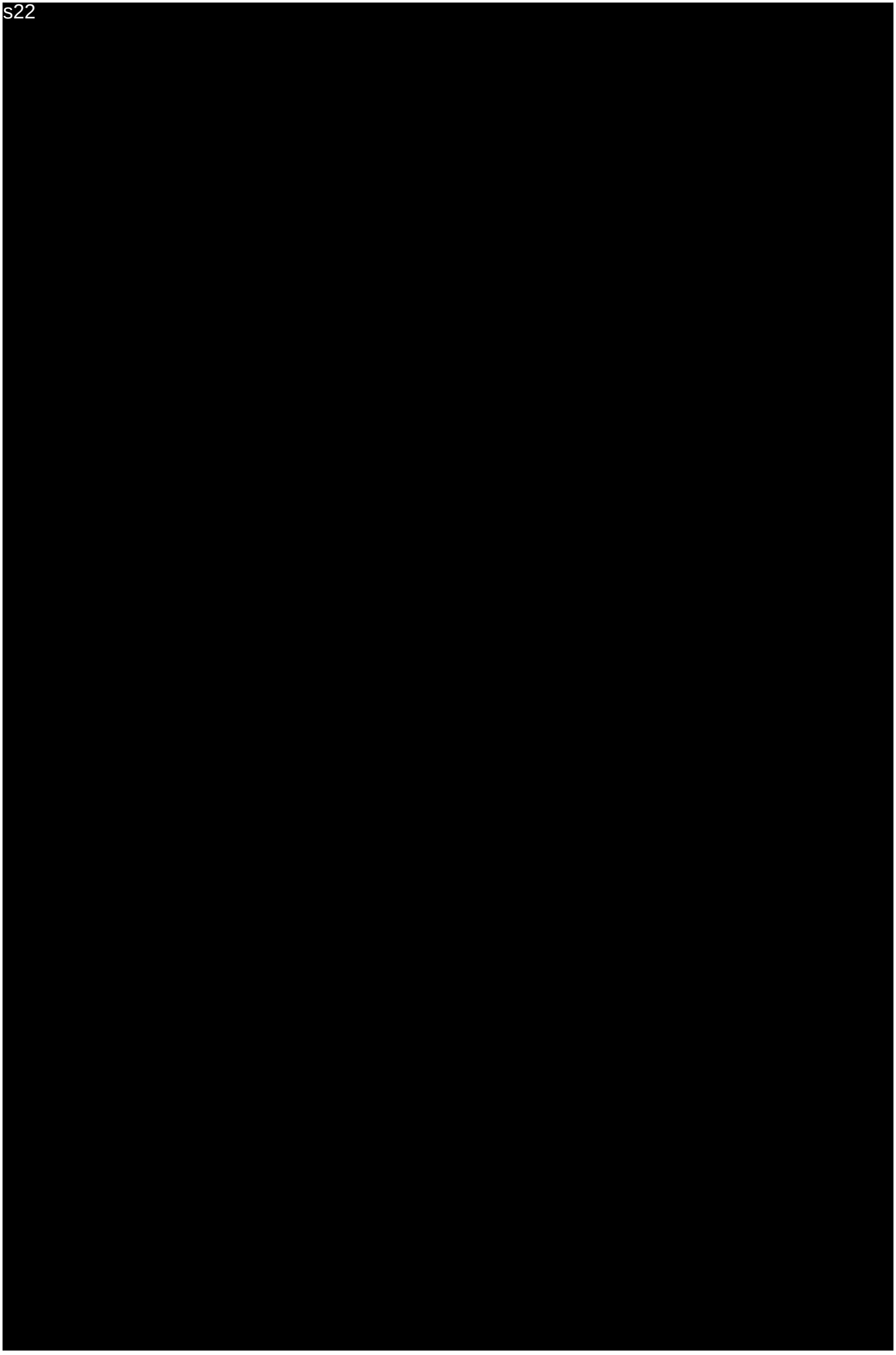

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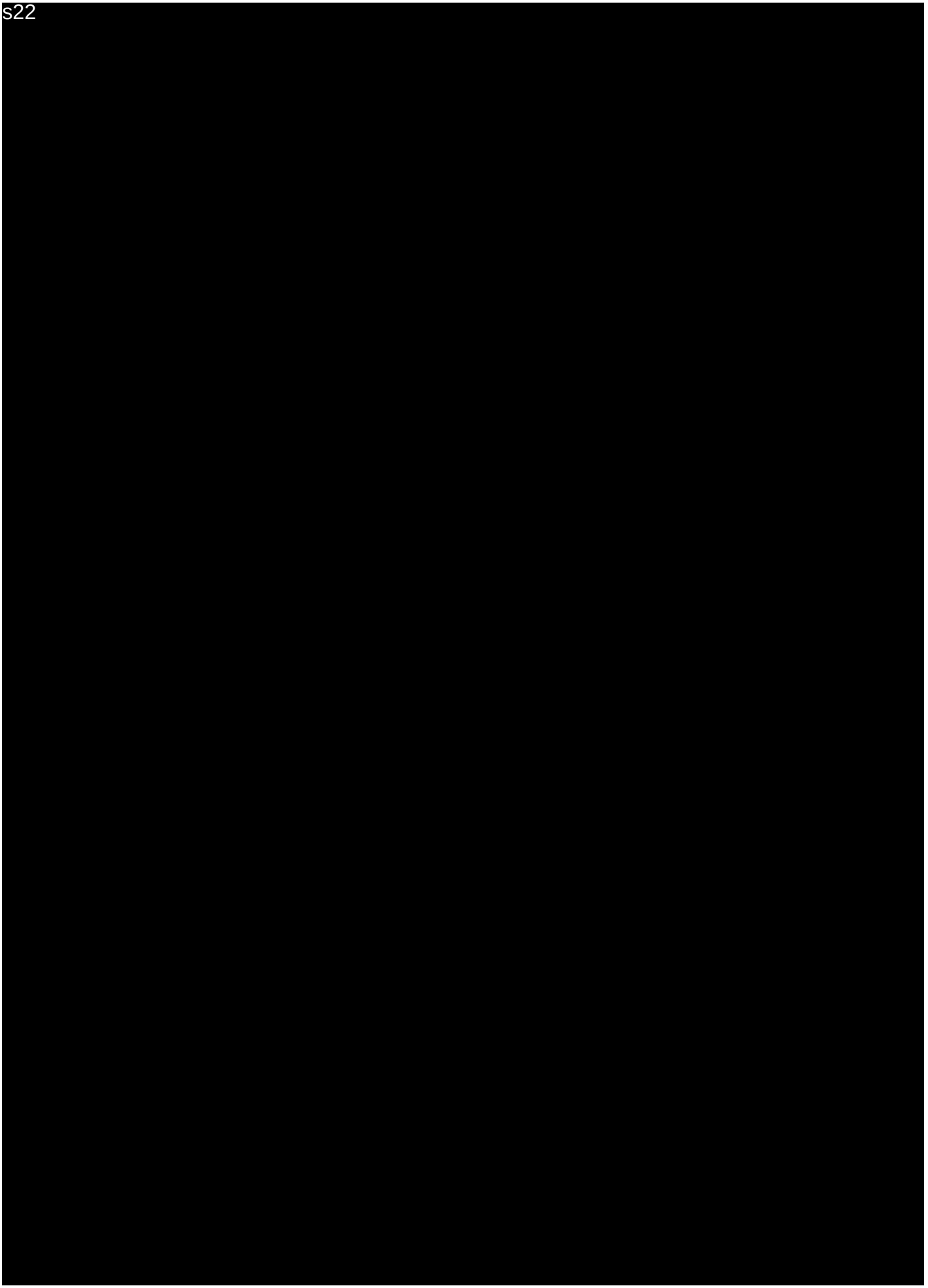

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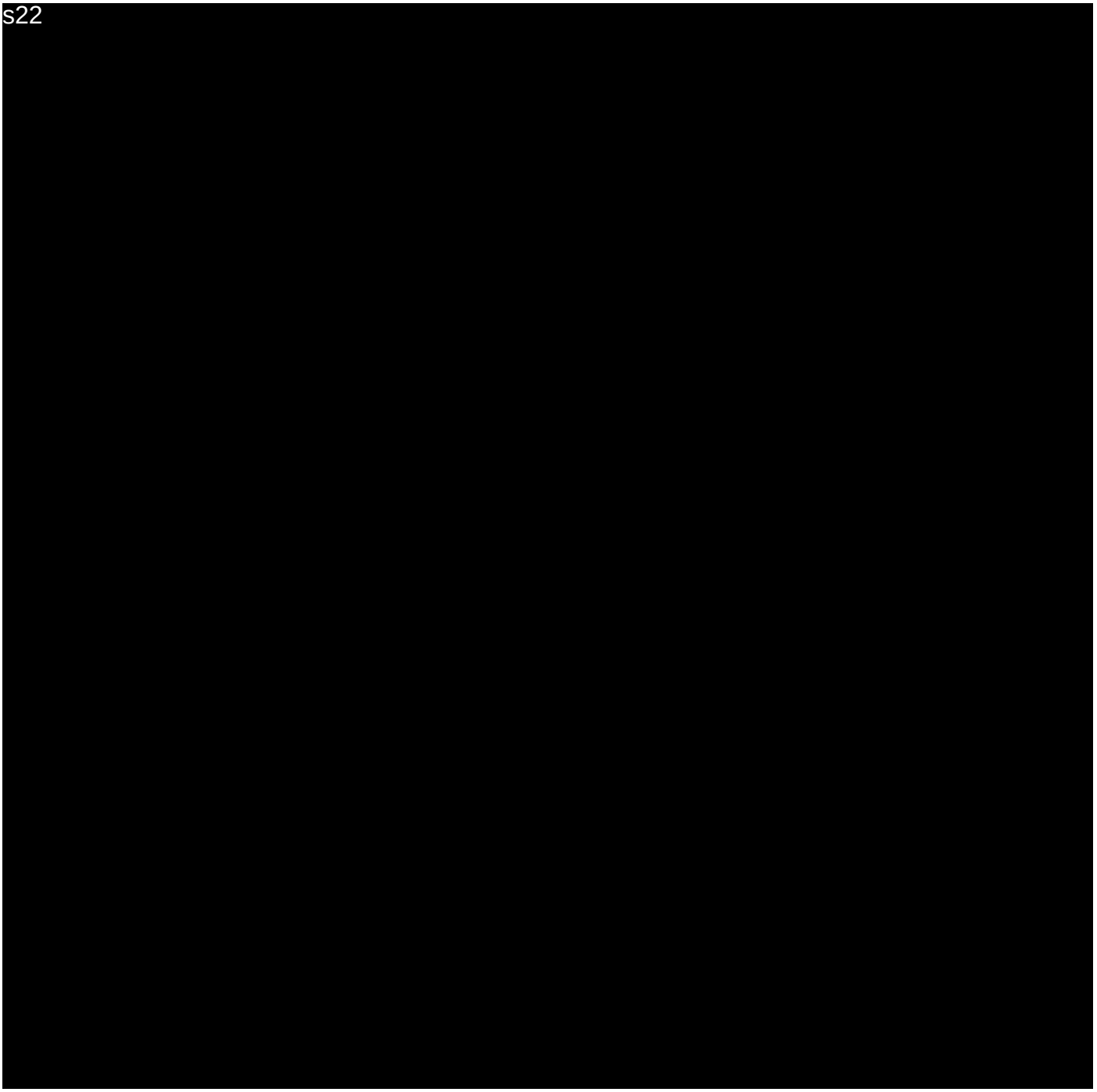

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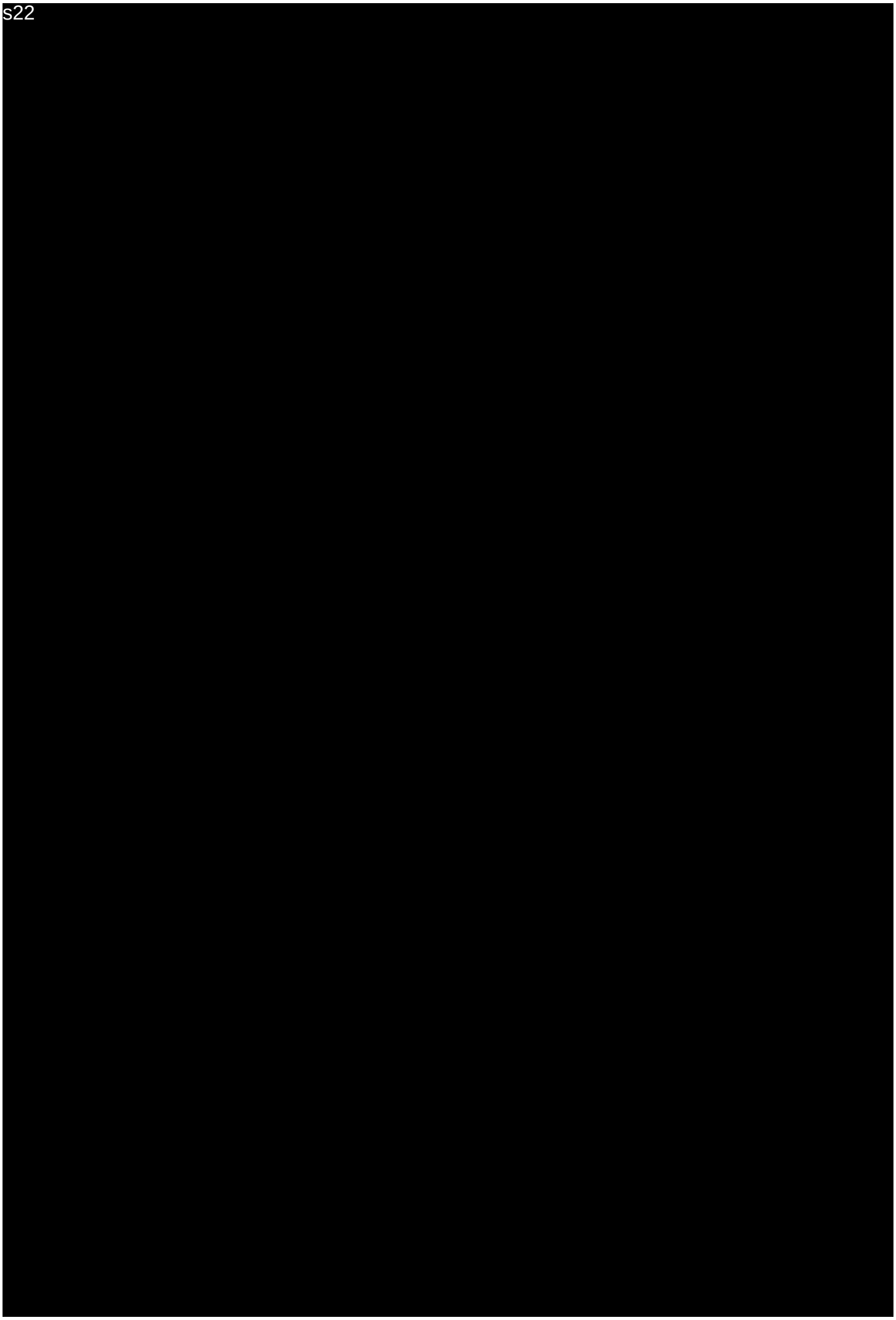

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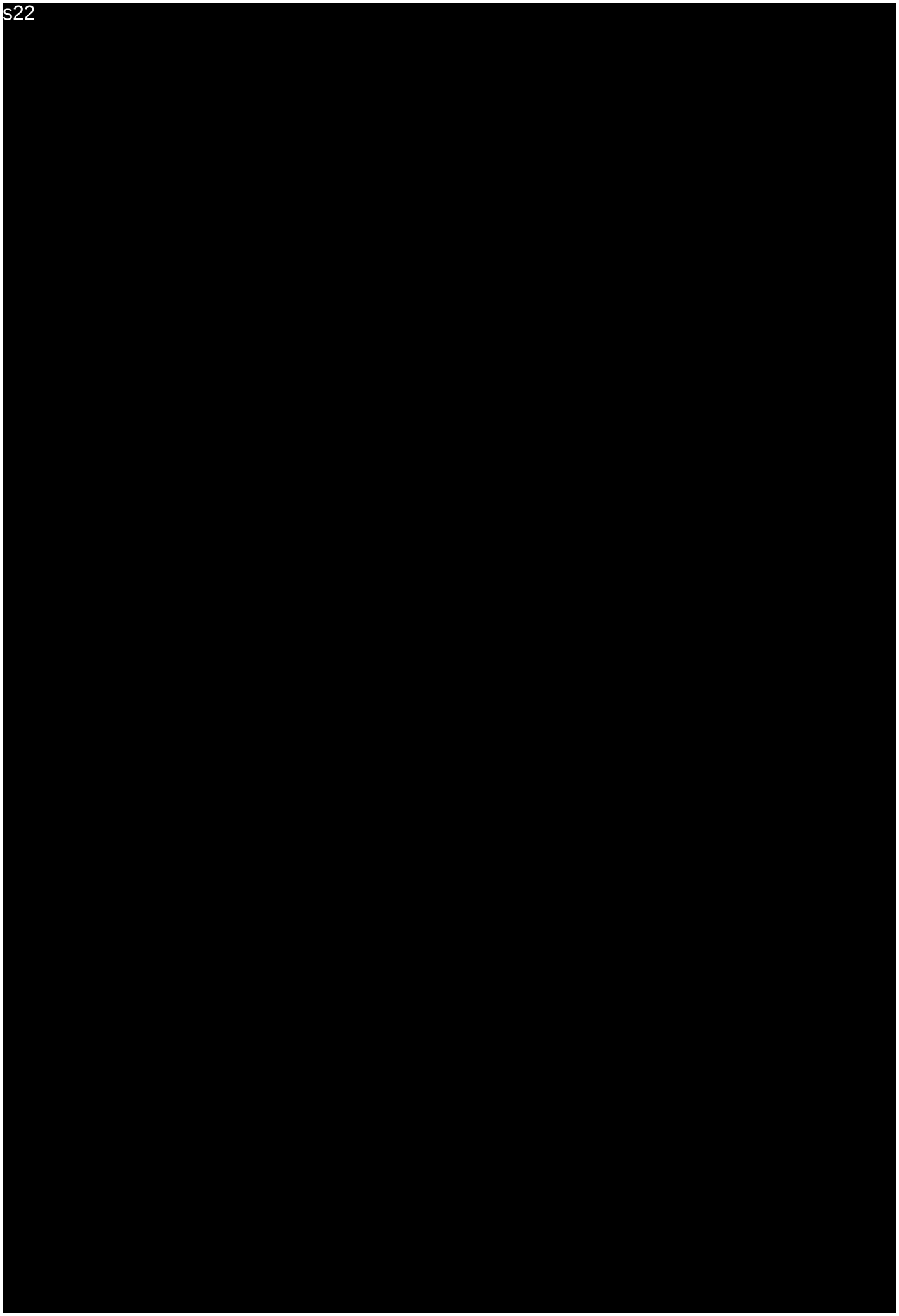

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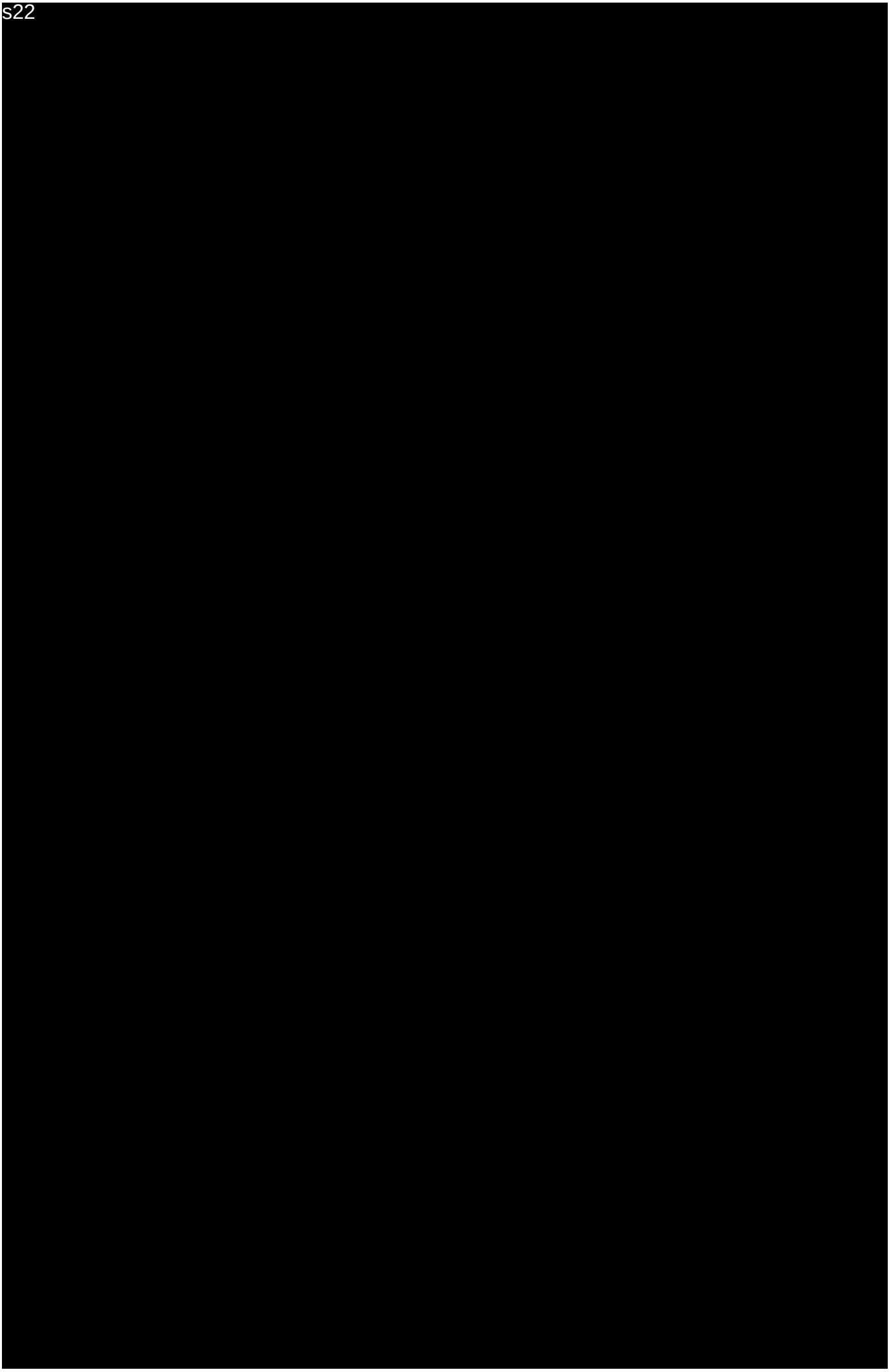

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Earth Covered Buildings

Requirement

106. **Overview.** There are numerous earth covered buildings at RAAF Base Tindal which are designed as hardened facilities for purposes such as accommodation, offices and operational support facilities. These buildings are characterised by a low earth mound exterior with the majority of functional space below ground, a single portal for access and no windows.

107. **Current State.** The exposed earth exteriors of all of the buildings inspected are experiencing some degree of erosion, due to the intense rainfall experienced during the wet season in Katherine from November to March. Compounding this problem is that during the dry season from April to October, little or no rainfall is experienced and as such vegetation does not grow which can mitigate erosion issues. The erosion issues are affecting the stability of the earth on the buildings, with significant displacement of sediment occurring at the base of the mounds. This is causing problems with access to some buildings.

Options considered

108. Details of options considered:

Option 1 – Do nothing
Description:
• Maintain existing earth and vegetation cover to buildings.

Option 1 – Do nothing	
Capital Cost	**WOL cost (3.7%)**
Nil	-$5,953,057
Advantages	**Disadvantages**
• No upfront construction costs	• Existing erosion will remain, potentially deteriorating with further rainfall in the wet season
Risks	**Opportunities**
• Further erosion may lead to exposure of building elements • Current eroded state of earth covered buildings is inhibiting vegetation growth	• Investigate options to increase vegetation coverage, particularly through the dry season

Option 2: Install impermeable erosion control membrane	
Description:	
Erosion control non-permeable membrane to match existing trial at Camp 3 • Prepare existing surface, reshaping the mound to rectify erosion furrows. • Create new drainage swale around base of building and near building entry location(s). Swale to be sized at 500mm deep x 1200mm wide. Provide four (4) swale spurs from the perimeter swale system extended 20 meters from building and discharge to open ground. • Membrane must be: - fire retardant and resistant to ember attack - coloured to match the surrounding area.	
Capital Cost	**WOL cost (3.7%)**
$2.573	-$2.115
Advantages	**Disadvantages**
• Mitigates current erosion issues experienced • Prevents the transmission of sediment from the mound • Continuity of membrane proposed to be installed at Camp 3 across other earth covered buildings • Lower maintenance costs	• Does not allow vegetation to grow • Artificial membrane which does not allow vegetation growth may diminish the buildings' camouflage from surroundings • Impermeable membrane will concentrate runoff from the mound at the base of the building and will require the construction of swales to manage this
Risks	**Opportunities**
• Present trial of impermeable geomembrane product at Camp 3 does not produce desirable outcomes • Weed control within the membrane may be an issue	• Investigate opportunities to undertake earth covered buildings scope through DEWPO

Option 3: Reshape earth mounds and install permeable membrane
Description:
Permeable erosion control via stabilisation similar to "Presto GeoWeb" • Prepare existing surface, reshaping the mound to rectify erosion furrows. • Create new drainage swale around base of building and near building entry location(s). Swale to be sized at 500mm deep x 1200mm wide. Provide four (4) swale spurs from the perimeter

Option 3: Reshape earth mounds and install permeable membrane	
swale system extended 20 meters from building and discharge to open ground. • Stretch membrane over mound and secure. • Membrane must be: - fire retardant and resistant to ember attack - coloured to match the surrounding area. • Backfill membrane webbing with soil • Provide vegetation seeding. • Install Presto Geoweb or similar permeable membrane	
Capital Cost	**WOL cost (3.7%)**
$3.176	-$1.221
Advantages	**Disadvantages**
• Mitigates current erosion issues experienced • Prevents the transmission of sediment from the mound • Lower maintenance costs • Allows for vegetation growth, allowing superior aesthetics to option 2	• Discontinuity of membrane solution as will be different to membrane installed at Camp 3
Risks	**Opportunities**
• Vegetation does not grow within membrane • Weed control within the membrane may be an issue	• Investigate opportunities to undertake earth covered buildings scope through DEWPO

Recommendation

109. **Option 1** is the preferred option for the Earth Covered Buildings for the following considerations:

a. DEWPO is presently undertaking a trial of an impermeable erosion control membrane at Camp 3. It would be prudent to await the completion of that trial in order to ascertain the efficacy of the solution trialled before expending further funds.

110. Further action:

a. Pending the outcome of the trial that DEWPO is presently undertaking at Camp 3, it is recommend that DEWPO investigate adding this package of works to future work programmes.