

# FORMER SOVIET MILITARY TRAINING AREA WITTSTOCK

REPORT ON THE CLEARANCE OF CLUSTER MUNITIONS FOR AN EXTENSION REQUEST UNDER  
ARTICLE 4 OF THE CONVENTION ON CLUSTER MUNITIONS

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# EXECUTIVE SUMMARY AND EXTENSION REQUEST

## LEGAL BASIS OF THE EXTENSION REQUEST AND LENGTH OF TIME REQUESTED

The Federal Republic of Germany ratified the Convention on Cluster Munitions on 8 July 2009; it entered into force on 1 August 2010. Under Article 4 of the Convention, Germany has an obligation to clear all cluster munition remnants from its territory within ten years after that entry into force. In 2011, the first indications of contamination with cluster munitions were discovered at the former military training area at Wittstock and immediately reported to the competent coordinating authorities and included in the annual transparency report submitted under Article 7. In 2019, Germany sought a five-year extension for its clearance obligations, until August 2025, in accordance with Article 4(5). The extension was granted by the 9<sup>th</sup> Meeting of States Parties on 2-4 September 2019. To explain that first extension request in 2019, Germany provided a comprehensive report.

As outlined in that report and as elucidated in its national statements during the 10<sup>th</sup> and 11<sup>th</sup> Meetings of States Parties in 2022 and 2023, various risk factors influence the pace of our clearing operations. Many of these are external factors, outside the control of the German authorities. Thorough assessment of the various risk factors indicates that, for the time being, it would be unrealistic to anticipate a further increase in the annual clearance rate. Consequently, Germany considers that it will be unable to fulfil its clearance obligations in time for the August 2025 deadline.

The present report is based on the first report submitted with the 2019 extension request. In accordance with Article 4(8) of the Convention, it contains relevant additional information on what has been undertaken during the previous extension. It is intended to inform the ISU, the Analysis Group and the 12<sup>th</sup> Meeting of States Parties in 2024, which will assess and decide on the extension request. Delegations to the Meeting of States Parties are invited to share their experience of clearing cluster munitions from contaminated military training sites to increase efficiency.

## EXTENT OF THE CONTAMINATION WITH CLUSTER MUNITIONS AND SPECIFICS OF THE SITE

The potentially contaminated area in the former Soviet training area near Wittstock, Brandenburg, is 1,100 hectares in size. As a result of continuous use of the area for military training purposes from 1953 to 1993, its overall contamination with unexploded ordnance and other remnants of war is particularly high, which makes the clearing of cluster munition remnants particularly difficult. After the active military use of the site ended, the area became part of a nature reserve. The requirements of conservation therefore have to be considered in the work to clear it of cluster munition remnants.

## STATUS OF CLUSTER MUNITIONS CLEARANCE

Following the development of the concept for cluster munitions clearance, a road network was developed and cleared to make the site accessible. Additionally, much effort was required to establish a fire containment system for the site, which was completed in 2016. This was a necessary condition for the controlled burning of the area that serves to make it accessible for cluster munitions clearance. Clearance

work proper started on the site in 2017. From March 2017 until August 2023, a total of 6,270,900 m<sup>2</sup> were cleared of cluster munitions. Some 4,732,100 m<sup>2</sup> are still to be cleared. During those clearance efforts, 6,850 cluster munition remnants were cleared and disposed of. About 60% of the cluster munition remnants were ShOAB-0.5 submunitions. The Wittstock site is heavily contaminated not only with cluster munitions but with all sorts of unexploded ordnance. Only around 5% of unexploded ordnance finds within the potentially contaminated area are actually cluster munition remnants. The rest consists of other unexploded ordnance (138,964 pieces cleared since 2017) as well as shell splinters, smaller pieces of ammunition and scrap metal (210 t cleared since 2017) and remnants of equipment (2,065 t cleared since 2017). This material considerably slows down the clearance campaign.

At the moment, 190 personnel are working on clearing the area, at an average daily clearance rate of 20 m<sup>2</sup> per person.

## FUNDING

The Institute for Federal Real Estate is providing the funding – approximately EUR 110 million up to August 2023 – for the clearance of cluster munitions at Wittstock.

## WORK PLAN FOR EXTENSION PERIOD AND RISK FACTORS AFFECTING FURTHER DELAY

For the extension period, the work will focus on clearing the remaining area potentially contaminated with cluster munition remnants. Based on current projections estimating a clearance rate of 85 hectares per year, completion of the clearance campaign is anticipated for 2029. The documentation will be finalised in 2030.

Based on experience gathered in the course of clearing cluster munitions at Wittstock so far, seven main factors with potential to cause further delay have been identified: (1) the number of EOD personnel, (2) the areas available after controlled burning (burning is restricted to a few days per year and contingent on metrological conditions), (3) the degree of contamination with cluster munitions, other ordnance and scrap, (4) meteorological conditions, especially extended periods of frost in winter, (5) the abundance of finds and necessary destruction work, (6) the COVID-19 pandemic and (7) procurement procedures for clearance work. Germany continues to monitor the abovementioned risk factors closely. Work plans are adapted and optimised on a constant basis. Adapted work plans are detailed in the present extension request. However, they cannot fully reflect all the above factors, as most of these, being external, lie outside the control of the German authorities.

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## DEFINITIONS

The Convention on Cluster Munitions (CCM) refers to “cluster munition remnants”, which was rendered as “*Streumunitionsrückstände*” in the German translation. For easier readability, the present report refers to them simply as “cluster munitions” (“*Streumunition*”).

The area concerned in the present report is known variously as “Wittstock”, “the former military training area of the Western Group of Forces (WGF) at Wittstock” and “the Kyritz-Ruppiner Heide site”. In the present report, it is referred to simply as “the Wittstock site”.

# 1. INTRODUCTION

At the Wittstock site, cluster munitions of the type ShOAB-0.5 have been found in the area of a mock airfield used for target practice (figure 1). By the end of 2016, a total of 14 finds of ShOAB-0.5 submunitions had been recorded.

In ratifying the Convention on Cluster Munitions (CCM) on 8 July 2009, the Federal Republic of Germany committed itself to clearing all cluster munitions. The CCM provides in Article 4(1)(a) for this to be completed not later than ten years from the date when the CCM entered into force for the State Party in question, i.e. by August 2020. Following extensive preparatory work essential to the clearance proper, Germany began clearing cluster munitions in March 2017. At the end of 2018, it became clear that, given the very high level of cluster munition contamination in the potentially contaminated area, clearance by 2020 would not be possible. Germany therefore, in accordance with Article 4(5), submitted an initial request in 2019 for an extension to the deadline for completing the clearance and destruction of the cluster munitions. That request specified a deadline extension to August 2021 and was granted by the Meeting of States Parties on 2-4 September 2019.

It is now apparent that the extended deadline cannot be met and a second extension is required.

To explain the first extension request in 2019, a detailed report dated 14 January 2019 was submitted.

The present report represents an update to that report. In addition, it provides relevant information on what measures have been undertaken since the extension was granted. It thus serves as indepth background to Germany's extension request in accordance with Article 4 of the CCM. The report keeps the participants of the Meeting of State Parties informed by explaining and documenting

- organisational and site-specific circumstances
- methodology and specialist procedures
- results achieved by the relevant reporting dates
- the special boundary conditions impeding clearance efforts

Participants of the Meeting of States Parties are also invited to contribute their specific methodological and technological experience to assist the clearance of the Wittstock site.



Figure 1: The ShOAB-0.5 submunition found on 10 July 2014



## 2. THE WITTSTOCK SITE

### 2.1. LOCATION AND SIZE

The Wittstock site is around 12,000 hectares in size. It is located in *Land* Brandenburg, some 80 km northwest of Berlin and 180 km southeast of Hamburg. The town of Neuruppin lies 20 km to the north; Wittstock is 15 km to the southeast (figure 2).

Because of its peripheral location, access to the site by public roads is limited. The internal network of roads has been upgraded to meet the requirements of forestry work and munitions handling.

The Wittstock site contains various types of vegetation cover, ranging from open landscapes dominated by heather to dense high forest. The dominant tree species is the Scots pine (*Pinus sylvestris*). The high ecological value of the natural environment, due particularly to the large open landscapes of heath and dunes, has resulted in large swathes of the site being granted protected status within the European Union's Natura 2000 network (as special areas of conservation and special protected areas).

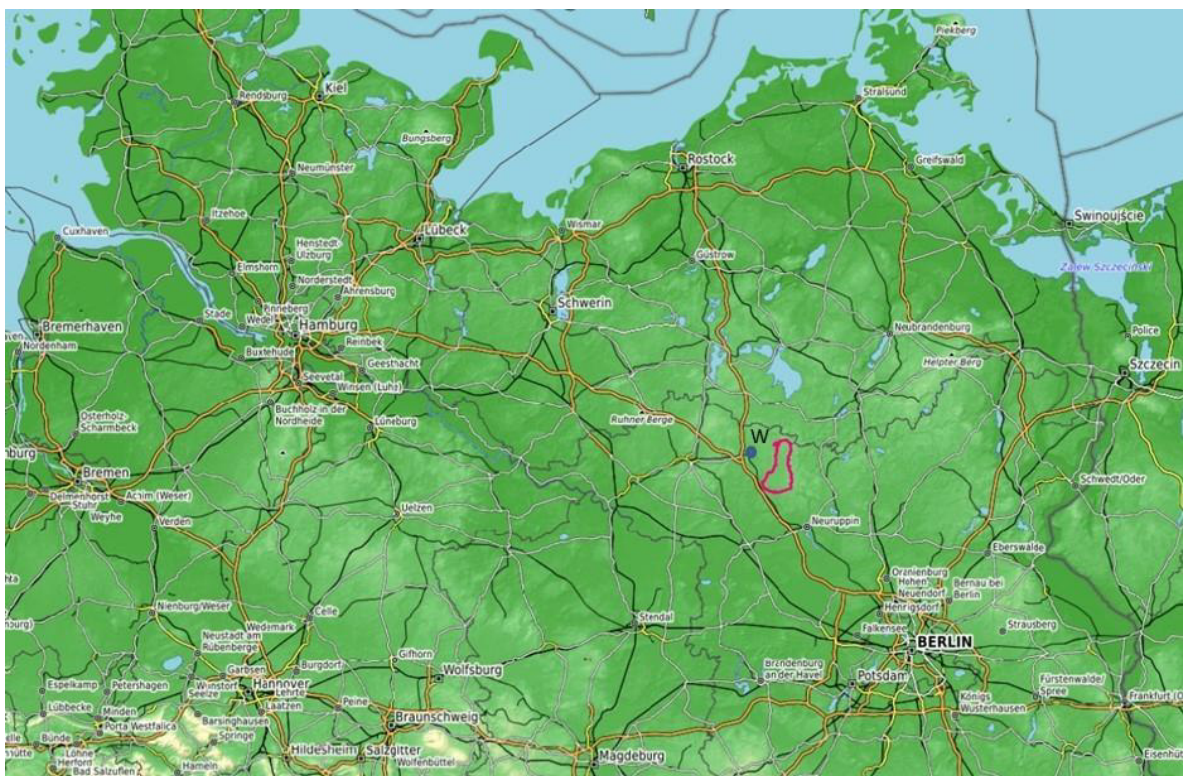


Figure 2: Location of the Wittstock site (red) in northeastern Germany between Berlin and Hamburg. The town of Wittstock (blue dot marked “W”) lies west of the site.

## 2.2. SITE HISTORY

Prior to its use for military purposes under the Third Reich, the site was used for forestry.

From around 1942/1943, in the southern part of the site only, the units stationed in Neuruppin used it for tank driving exercises and the Wehrmacht held artillery and air-defence training there.

Intensive, permanent military use only began after the end of the Second World War, when Soviet troops took over the site.

The military training area and bombing range was the northernmost of three air force training areas that the Western Group of Forces (WGF) maintained in the territory of what was then the German Democratic Republic. It was used by troops from all the Warsaw Pact states as a firing and bombing range.

Ground forces used the training area for exercises with battle tanks, armoured infantry fighting vehicles and self-propelled anti-aircraft guns. Air force troops used the site for training with bombers, fighter-bombers and helicopters. In summary, it was host to the whole inventory of military technology and conventional munitions that ground and air forces had at their disposal between 1949 and 1993 (figure 3).

The former training area is divided into firing and non-firing zones.

Used for weapons training, firing zones were primarily located in the southern and central parts of the training area, south of the local road connecting Schweinrich and Flecken Zechlin.

Used primarily for exercises in attacking ground targets from the air, the air force bombing range was located in the southern portion of the central part – which also contains the actual area potentially contaminated with cluster munitions. In the 1960s, bombing exercises were carried out with both live and practice ordnance. In the 1970s and 1980s, elaborate mock ground targets were erected within the air-to-ground impact area, including a replica of a NATO airfield with external base defence facilities and an artillery emplacement. The wider surroundings of the mock airfield contained several ground target arrangements representing various missile emplacements (for Nike, Hawk, Pershing, Patriot and Lance missiles), armoured columns and more artillery emplacements. There are also four impact areas for artillery target practice.

Soviet military use ended with the withdrawal of WGF troops from Germany in 1993. The site passed to the Bundeswehr, which planned to establish an air-to-ground training area there. Those plans were abandoned in 2009 before the site had been put to the intended use. The site was handed back to the Institute for Federal Real Estate on 1 October 2011 and has since been administered by the Westbrandenburg branch of the Federal Forestry Service.

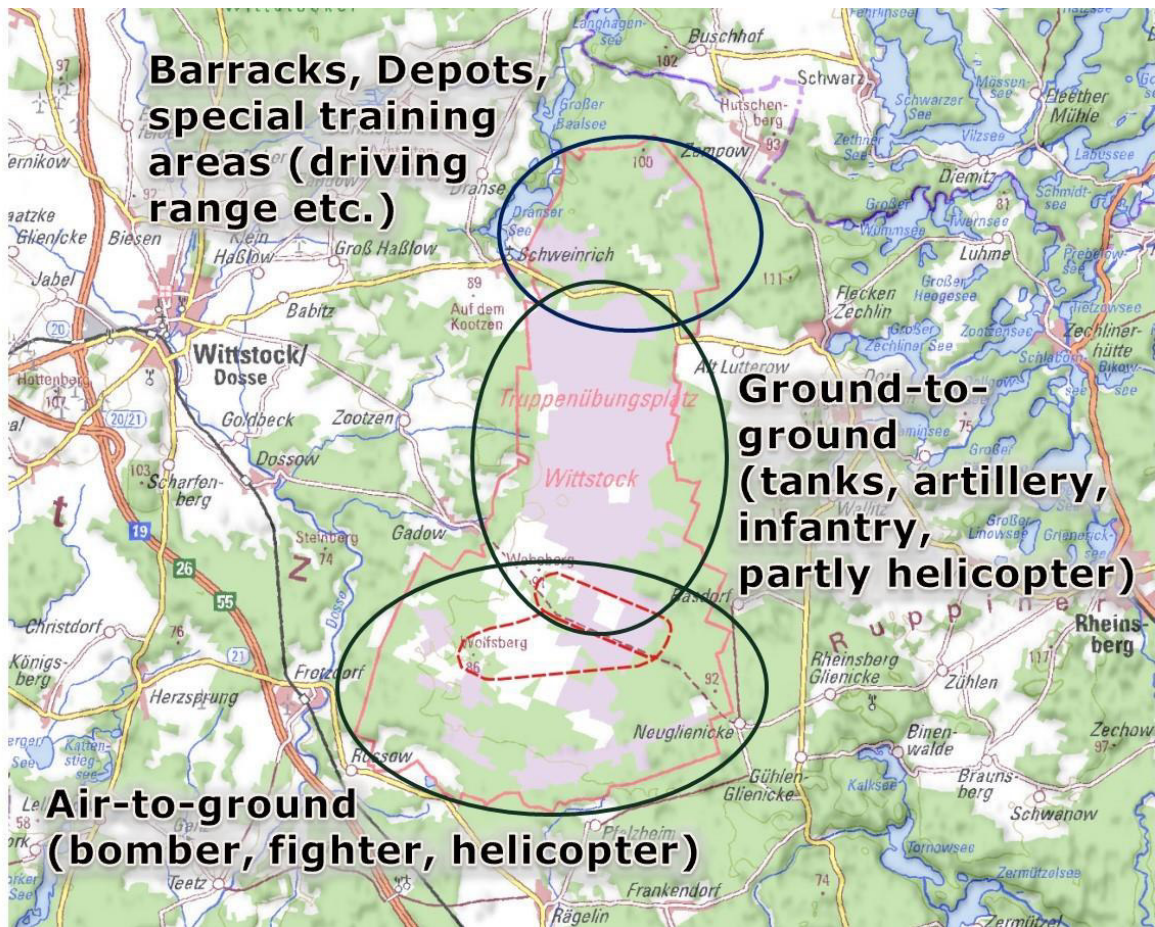


Figure 3: Large-scale military use of land within the Wittstock site by the Western Group of Forces (WGF). The area potentially contaminated with cluster munitions is highlighted with red dashes.

### 2.3. CURRENT USE

Because a wide area is potentially contaminated with ordnance, the Wittstock site is closed to public access by local by-law (*Ordnungsbehördliche Verordnung zum Beschränken des Betretens* or *Sperrverordnung* for short). The entry ban is monitored regularly. Signs surrounding the Wittstock site at 50-metre intervals advise the public of the facts (figure 4). Anyone violating the ban is prosecuted and penalised. Hazards for public safety and public order are thus averted.

In addition, the competent hazard-aversion authorities and the general public are kept informed on a regular basis of the dangers and the munitions clearance work. This is achieved through information events, press releases and leaflets.

Because of the dangers posed by unexploded ordnance (UXO), only parts of the Wittstock site are used for forestry and conservation; personnel are trained in respect of the special circumstances and familiar with the local area. In the very south of the site, around 2.5 km south of the potentially contaminated area, a road had

already been completely cleared of cluster munitions and, once clearly signposted, opened to the visiting public by the Ostprognitz-Ruppin district authorities in 2017. On 1 January 2023, a further 1,000 hectares to the south and north of that route were released for public use.

Depending on local conditions, particular additional roads, suitably signposted and far from the potentially contaminated area, may be opened to the public in the future.

In light of its contamination with cluster munitions, there is no intention to make the site as a whole accessible to the public at present or in future.



Figure 4: Signs placed every 50 m around the site perimeter advise the public of the dangers and prohibit access (“Danger to life! Unexploded ordnance. No entry on foot or by vehicle!”).

### 3. GIVENS AT THE START OF WORK IN 2016

#### 3.1. THE POTENTIALLY CONTAMINATED AREA

At the Wittstock site, ShOAB-0.5 submunitions have been found in the area of a mock airfield created for bombing practice in the southern portion of the central part of the site. By the end of 2016, a total of 14 finds of ShOAB-0.5 submunitions had been recorded. The boundaries of a potentially contaminated area were drawn on the basis of

- those finds
- the results of historical research into the military use of the site
- the knowledge of the landscape and vegetation gleaned from many years of site management by the local forestry personnel (since the withdrawal of Soviet troops)

As well as the mock airfield and other areas in the vicinity, it contains a zone which could at the time be assumed, with a high degree of probability, to harbour cluster munitions. The potentially contaminated area thus drafted comprises approximately 1,100 hectares, or 11 million square metres (see figure 5).

The vegetation cover and the particular danger arising from the cluster munitions suspected of being present within the potentially contaminated area made technical investigation (e.g. clearance of testbeds) impossible.

#### 3.2. GIVENS AFFECTING THE PLANNING OF MUNITIONS CLEARANCE

Knowledge pertaining to the historical use of the site by the Soviet armed forces, most recently by the Western Group of Forces (WGF), is very limited. Requests for the relevant information from Russian government bodies were unsuccessful. Russian archives that might provide information are not accessible. Accordingly, the planning and implementation of cluster munitions clearance can currently rely only on general information regarding the site's historical use. The area potentially contaminated with cluster munitions was used

- as an air-to-ground firing range and bombing range
- as an impact area for artillery firing exercises
- for exercises with infantry munitions (both practice and live ordnance)

Therefore, the full spectrum of such munitions used by the former Warsaw Pact states can be expected. The overall assessment of the hazards depends crucially on the following:

1. Cluster munitions: ShOAB-0.5s are known only in the form of live ordnance; a practice version with an inert or marker load is unknown. The ShOAB-0.5 has an all-ways-acting fuse and contains 85g of explosives (70% hexogen, 30% TNT). Because of the fuse mechanism and mode of operation, unexploded ShOAB-0.5 submunitions can only be considered possible to handle and transport, with restrictions, subject to special safety precautions, as even slight mechanical influences and movements can cause the fuse to be triggered and consequently the approximately 85g of explosives to react. The

ShOAB-0.5 is the smallest of all Soviet submunitions and that with the lowest ferrous metal content. In total, 14 ShOAB-0.5 were found by chance prior to the start of the systematic cluster munitions clearance campaign.



2. WGF munitions: Apart from cluster munitions, the potentially contaminated area contains all kinds of Russian air-to-ground, infantry, artillery and tank ammunition. The vast majority of it must be considered fused UXO. Some of those fuses must be classified as unsafe to handle or transport. Fused ordnance like this, particularly because of the size of some items (up to 500 kg bombs), presents a hazard for everyone involved in clearance work.
3. Vegetation: Furthermore, it has to be taken into account that the area in question is covered by dense vegetation (ecological succession of heather, pine and birch). The ground tends to be difficult or impossible to see (see figure 6). In parts, moreover, the surface is highly uneven over short distances, with numerous bomb craters, ditches, emplacements, etc.

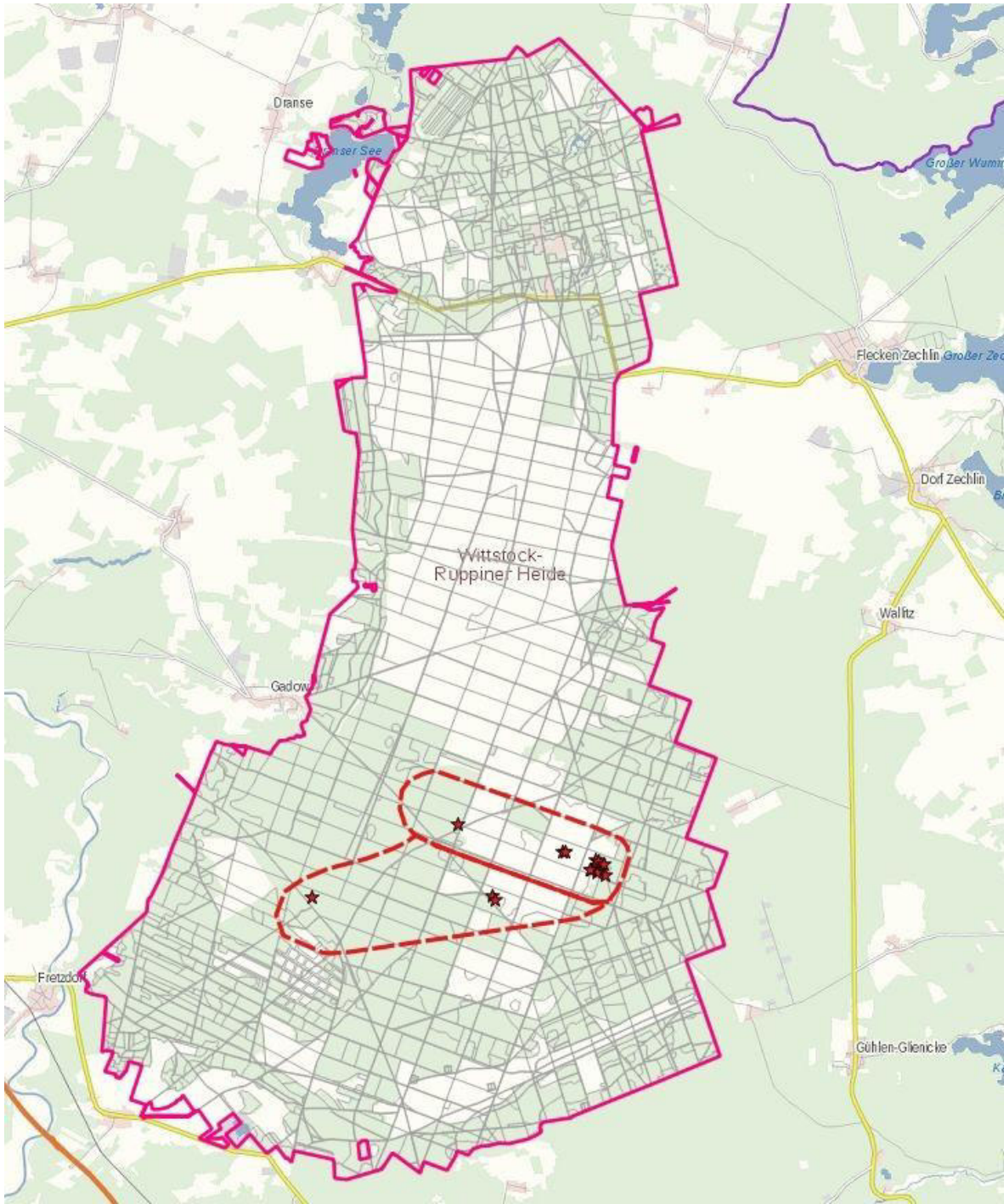


Figure 5: The area potentially contaminated with cluster munitions (dashed red lines) with the locations where ShOAB-0.5 had been found up to 2016 (red stars), within the Wittstock site (magenta lines)

### 3.3. RESPONSIBILITIES AND PARTIES INVOLVED IN MUNITIONS CLEARANCE

As a form of hazard aversion, the destruction and disposal of UXO is subject to police and regulatory law and therefore falls within the remits of Germany's *Länder*. Almost all the *Länder* have set up munitions clearance agencies to deal with these tasks. In Brandenburg, the relevant agency is the *Kampfmittelbeseitigungsdienst Brandenburg* (KMBD Brandenburg), which is part of the Brandenburg *Land* police force.

The Federal Government has no jurisdiction to maintain a munitions-disposal agency.

In order to ensure a harmonised approach across its properties, the Federal Government has set up the *Leitstelle des Bundes für Kampfmittelräumung*, a federal coordination centre for munitions clearance, attached to the NLBL, the Lower Saxony office for construction and property, in Hanover. The munitions clearance guidelines drawn up by the coordination centre, entitled *Baufachliche Richtlinien Kampfmittelräumung zur Erkundung, Planung und Räumung von Kampfmitteln auf Liegenschaften des Bundes*, form the binding basis of all munitions clearance work on Federal Government properties, including the Wittstock site.

To specify the procedure to be followed for the intended work, site-specific work instructions have been drafted. These have been approved by the relevant munitions-disposal agency. They cover the following aspects:

- detection of munitions (instruments and their use) (see also subsection 3.5)
- handling of cluster munitions and other explosive ordnance (relocation and destruction)
- documentation

As a rule, the *Land* clearance agencies do not conduct their own munitions clearance projects. Clearance work (search, uncovering, identification, recovery and preparation for destruction and disposal by the *Land* agency) is generally conducted by specialist commercial contractors, which need to meet the requirements of the Explosives Act (*Sprengstoffgesetz*). These contractors are mostly small enterprises with a few dozen employees and the corresponding amount of equipment. The companies tend to operate on a regional scale. Only a few have more than 100 employees. Of the specialist staff they employ, a large number are usually tied down by long-term framework agreements with larger local authorities and *Länder*, leaving them with no or only very limited availability for other tasks. There were about 1,500 people working within the fragmented edifice of Germany's commercial munitions clearance sector in 2016.

In Brandenburg, under the *Land* Munitions Ordinance (*Kampfmittelverordnung*), the relocation and destruction of explosive ordnance is the sole responsibility of KMBD Brandenburg.

Regarding the requirement under Article 4(3) of the CCM to take into account the International Mine Action Standards (IMAS), cluster munitions clearance, including all preliminary and follow-up work, is conducted in accordance with German federal law and the legislation of *Land* Brandenburg, the occupational safety standards published by the German Statutory Accident Insurance Association (*Deutsche Gesetzliche Unfallversicherung*, DGUV) and the federal guidelines for munitions clearance (*Baufachliche Richtlinien Kampfmittelräumung des Bundes*). These federal and *Land* provisions are binding and take precedence over the application of international health and safety or technical standards in Germany.



### 3.4. DISTRIBUTION AND PENETRATION DEPTH OF SHOAB-0.5

When clearance work began, only isolated finds of ShoAB-0.5 were known. More indepth information, e.g. regarding contamination hotspots, was not available and could not be derived from the known facts because of the geographical distribution of the isolated finds.

Because of their form and their rate of rotation in flight, it can be assumed that ShoAB-0.5 tend not to penetrate into the ground or to penetrate only to shallow depths. This assumption correlates with findings from, for example, Southeast Asia, where the penetration depths of cluster munitions have informed the following standard clearance depths:<sup>1</sup>

- clearance depth in Cambodia: 20 cm
- clearance depth in Laos: 25 cm
- clearance depth in Viet Nam: 30 cm



Figure 6: Heath vegetation and large-calibre air-dropped munitions inside the potentially contaminated area

Because 30 to 55 years have passed since cluster munitions are thought to have been used at Wittstock, it must be anticipated that a ShoAB-0.5 submunition lying on the surface may by now be obscured or covered by dense vegetation (moss, grasses, heather, etc.). It would typically be no longer directly visible today.

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<sup>1</sup> White, R. (2017) The Challenge of Long-term Risk Management in Mine Action, *Journal of Conventional Weapons Destruction*, volume 21, issue 3, pp. 56-60



### 3.5. MEANS OF DETECTION

The ShOAB-0.5 found by chance in July 2014 was investigated in situ with instruments conventionally used for UXO detection in Germany (gradiometers for surface-based geomagnetic surveys). With approximately 10 cm between the ShOAB-0.5 submunition and the detector, a measurement of 40 nT was recorded. From 30 cm away, which would be the maximum distance during normal munitions clearance, the measurement was reduced to 3-5 nT. Such values are indistinguishable from the background noise expected in and around the potentially contaminated area, which is due to the widespread presence of scrap and/or munitions. On the basis of that finding, current knowledge therefore suggests that it would be of no or limited use to search for ShOAB-0.5s with commonly available gradiometers.

In the light of those findings, an experiment to compare various commonly available devices for the detection of UXO was conducted in October 2016. UXO detectors are based on standard metal detectors, but various adaptations (e.g. larger coils, use of later time gates) optimise their capacity to suppress small metal objects (e.g. fragments, bottle caps, nails) and specifically target larger metal objects at greater depths. Following market research, three such instruments were selected for testing. The experiment found that the depth of detection was similar for all three instruments. However, in respect of their capacity to distinguish between smaller anomalies (which do not have to be cleared) and larger anomalies (which could represent cluster munitions), the Minelab F3 UXO proved best suited to the task.

Experience gained during the clearance work has shown that larger cluster munitions deeper below the surface can be reliably located using the sensing technology deployed.

### 3.6. FOREST FIRE HAZARD

The Kyritz-Ruppiner Heide landscape in which the Wittstock site is located is highly susceptible to forest fires because of the geological and meteorological conditions. That circumstance has been significantly exacerbated in recent times by the changes discernible in the climate, with particularly hot and dry summer months. Sandy soils with low nutrient content, low water-storage capacity and average annual precipitation of around 560 mm, in combination with the prevalent vegetation consisting of Scots pine (*Pinus sylvestris*), heather (*Calluna vulgaris*), broom (*Genista* spp.) and various grasses, result in a high risk of forest fires almost throughout the year. For that reason, section 23 of the Brandenburg Forestry Act (*Landeswaldgesetz Brandenburg*) – irrespective of the current level of forest fire warning – prohibits the lighting of fires and smoking in or within 50 m of woodland all year round.

For the Wittstock site, the Institute for Federal Real Estate (specifically, the Westbrandenburg branch of the Federal Forestry Service), in collaboration with the competent public bodies, has put in place numerous measures to prevent forest fires and to mitigate hazards in the event of fire. For example, in view of the local situation and the vegetation, a firebreak 50 m wide and 90 km long has been established surrounding the entire site, supplemented by a system of firebreaks and corridors kept free of vegetation within the site (see figures 7 and 8). Around the actual area potentially contaminated with cluster munitions, various firebreaks have been established totalling around 67 km in length (see section 6 for details). Additionally, on the

periphery of the site, numerous fire cisterns have been installed on HGV-capable access routes to provide water for firefighting in the event of an emergency.

The entire fire containment system, both within and outside the area potentially contaminated with cluster munitions, is located in areas potentially contaminated with ordnance of some kind and therefore had to be cleared of munitions before it could be established.

Because of the contamination with unexploded ordnance and the local by-law consequently prohibiting public access to the site, firefighting can only be conducted from the edge of the site. For safety reasons, fire brigades are not allowed to enter the site in the event of a forest fire.

In that context, special safety precautions with regard to forest fires and official special permission for the use of fire on the Wittstock site are required before controlled burning of vegetation prior to clearance operations can take place in the area potentially contaminated with cluster munitions. Before the controlled burning of the area in sections could be allowed, it was essential to create and maintain a system of firebreaks (as described above/below) to prevent forest fires. An effective system of firebreaks was also a prerequisite for obtaining the special permission for controlled burning from the competent authorities.

### 3.7. LOCATION WITHIN A SPECIAL AREA OF CONSERVATION; CONSERVATION AND ENVIRONMENTAL CONSIDERATIONS

The whole of the area potentially contaminated with cluster munitions is located within the Wittstock-Ruppiner Heide special area of conservation (SAC), the largest contiguous area of heather-rich habitat in Germany (site DE 2941-302 within the NATURA network).

Under Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive, OJ L 206, 22 July 1992, p. 7), as amended by Council Directive 2013/17/EEC of 13 May 2013 (OJ L 158, 10 June 2013, p. 193), the natural habitat types of Community interest found within the SAC must be conserved. In the area potentially contaminated with cluster munitions, the habitat types in question are as follows:

- 4030 – European dry heaths
- 2310\* – Dry sand heaths with *Calluna* and *Genista*
- 2330\* – Inland dunes with open *Corynephorus* and *Agrostis* grasslands

A favourable conservation status has to be pursued for all habitat types; plans and projects within the site boundaries must not cause a significant deterioration in the condition of the protected natural assets and an assessment of their implications must be carried out. The EU member states bear particular responsibility in respect of the priority natural habitat types, which include types 2310 (dry sand heaths with *Calluna* and *Genista*) and 2330 (inland dunes with open *Corynephorus* and *Agrostis* grasslands). All the habitat types specified are moreover classified under section 30 of the Federal Nature Conservation Act (*Bundesnaturschutzgesetz*) as protected biotopes which must not be destroyed or significantly adversely affected, even temporarily, without official permission. Similar protections apply in respect of the many animals living on the heath which are classified as strictly or specially protected fauna species under section 44 of the Federal Nature Conservation Act.

All measures therefore require close coordination with the relevant conservation authorities. Cluster

munitions clearance is organised in such a way as to keep interference with the natural environment as low as possible and thereby serve the conservation objectives of the Habitats Directive. Heather burning, for example, is used elsewhere as a land-management measure. Special value is placed on conserving the priority natural habitat types. For instance, measures implemented around what used to be shifting dunes are designed to ensure that, after completion, the area once again has the characteristics of the shifting dune habitat.

Wherever possible, synergies between munitions clearance and nature conservation are exploited. Where that is not possible, additional funds are made available for compliance with the stipulations of conservation law.

## 4. CONSIDERATIONS REGARDING THE SUITABILITY OF CLEARANCE METHODS

The planning of explosive-ordnance disposal (EOD) work had to take into account

- the available information on the inventory of munitions
- the detectability of ShOAB-0.5 submunitions
- the lack of location-specific data on contamination density
- the dense vegetation cover
- the necessary fire containment measures
- the limited infrastructure
- the limited availability of specialist EOD personnel

Careful consideration of these factors led to the conclusion that the investigation and clearance could not be conducted effectively using standard methods of munitions clearance. The reasoning is set out in detail below.

### 1. Manual clearance (full-area, selectively sub-surface clearance)

Manual clearance in accordance with the methodology set out in the federal guidelines<sup>2</sup> for full-area, selectively sub-surface clearance (*vollflächige, punktuell bodeneingreifende Kampfmittelräumung*), which requires the constant presence of personnel in the area and the extensive removal of heath vegetation prior to clearance proper, must be considered unworkable given the endangerment of personnel. This procedure is considered too dangerous given the abundance of munitions, particularly the high proportion of munitions assessed as unsafe for handling.

Manual clearance in the manner of land mine clearance is also not an option because of the immense efforts required and the hazards posed to clearance personnel.

### 2. Mechanical clearance (munitions clearance by removal of soil and other materials [volume clearance/separation])

Purely mechanical clearance in accordance with the methodology set out in the federal guidelines for munitions clearance by removal of soil and other materials (volume clearance/separation) (*Kampfmittelräumung durch Abtrag von Boden und sonstigen Stoffen [Volumenräumung/Separation]*), e.g. using tiller systems (Krohn, Minewolf, Keiler or similar) would be feasible in respect of ShOAB-0-5 submunitions alone, but the additional hazard posed by the presence of large-calibre air-dropped munitions and shaped-charge munitions renders it doubtful. The mechanical disturbance caused by a tilling system could be expected to trigger large-calibre air-dropped bombs. Given the large amounts of explosives involved, this would result in the destruction of the equipment. Moreover, areas usually cannot be cleared completely using tilling systems if large obstacles (underground architecture, large steel objects, etc.) are

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<sup>2</sup> Published by the Federal Ministry of the Interior and the Federal Ministry of Defence in collaboration with the Institute for Federal Real Estate, the federal guidelines for munitions clearance, *Baufachliche Richtlinien Kampfmittelräumung des Bundes*, (September 2018 edition) are available in German at [www.bfr-kmr.de](http://www.bfr-kmr.de).

present. Tilling can also result in the release of explosives into the environment, causing widespread contamination with explosive compounds. Such pollution is expressly prohibited under German environmental legislation.

### 3. Controlled burning and subsequent clearance

Because standard manual and mechanical clearance have such considerable disadvantages that they must be considered unworkable, an alternative concept for the clearance of cluster munitions has been developed. That concept comprises the controlled burning of vegetation followed by full-area, selectively sub-surface clearance to process the upper layers of the soil.

For those areas very highly contaminated with ferromagnetic metal objects, which became increasingly evident in the course of clearance work, controlled burning and clearance of larger munitions were followed by volume clearance using screening buckets. The screening buckets are attached to armoured excavators, the operation of which is supervised by licensed personnel via video.

Considering the local conditions, this is the preferred method for clearing cluster munitions from the potentially contaminated area.

As described above, the clearance of cluster munitions at Wittstock is divided into the following steps:

- desk study and creation of access and evacuation routes (see section 5)
- preparation of the area for controlled burning (see section 6)
- controlled burning of vegetation (see section 7)
- cluster-munitions clearance proper (see section 8)
  - by means of selectively sub-surface clearance of anomalies in less contaminated areas (see subsection 8.1)
  - by means of selective clearance and volume clearance using video-monitored screening buckets in more densely contaminated areas (see subsection 8.2)

## 5. PREPARATION OF THE SITE: DESK STUDY AND ACCESS AND EVACUATION ROUTES

Following the handover of what was then a military training area by the WGF to the Bundeswehr in 1993, the Bundeswehr conducted various surveys in connection with plans to continue its use for military purposes. Of particular note is a 2001/2003 extensive UXO desk study (German: *Historisch-genetische Rekonstruktion*) reconstructing the military use of the training area, which yields a range of information on its use in the early 1950s and the 1990s. In the absence of suitable historical sources, it was impossible to reconstruct the intervening years between circa 1955 and circa 1990. This circumstance remained unchanged despite the efforts of the Federal Forestry Service following the handover of the site from the Bundeswehr to the Institute for Federal Real Estate. It was not until 2017 that satellite images could be procured which yielded information on the basic facilities and particularly on the position of impact areas. Because of the known contamination of the site with unexploded ordnance, the site was kept closed to the public Estate by means of a local public-safety by-law (*Sperrverordnung*) after the Bundeswehr handed it over to the Institute for Federal Real, to avert risks to public safety and order (see subsection 2.3).

At the same time, a strategic concept (*Strategisches Handlungskonzept – SHK*) for the management and development of the site was developed, summarising what was known about the munitions contamination of the site at that time.

The SHK, various UXO clearance campaigns and the historical desk study served as a basis to draw up the following:

- a fire containment plan
- a network of access and evacuation routes
- an emergency response and hazard aversion plan

The fire containment plan was necessary so that potential wild-fires could be contained and fought. The network of evacuation and access routes was needed, among other considerations, to facilitate and guarantee safe access to the area then recognised as potentially contaminated with cluster munitions. That safe access was and remains a prerequisite for the use of commercial contractors specialising in cluster-munitions clearance and for the installation of the fire containment system by suitable specialist companies.

The roads and firebreaks thus identified were investigated by means of a full-area geomagnetic survey in 2013.

Building on that survey, a representative selection of testbeds were cleared in 2014.

The results were collated in an access concept for organisations and authorities with public-safety functions (*Zugangs- und Betretungskonzept für die Behörden und Organisationen mit Sicherheitsaufgaben* or *BOS-Konzept* for short).

Those preparations laid the groundwork for establishing the fire containment system around the area potentially contaminated with cluster munitions and ensuring access to that area.

## 6. PREPARATION OF THE SITE: FIRE SAFETY AND CONTAINMENT SYSTEM

Controlled burning to clear vegetation requires preparation of the site to make sure the fire remains safely confined to the intended area. Considering the high risk of forest fires due to the prevalence of pine trees, the fire containment system must reliably prevent both surface and crown fires from spreading to neighbouring areas.

The Westbrandenburg branch of the Federal Forestry Service has developed such a fire containment system consisting of multiple layers of security:

- outer firebreak
- first inner firebreak
- second inner firebreak
- interior roads
- additional firebreaks, to be created as required

The various elements of the fire containment system are arranged as follows (see figure 7):

- The outer firebreak (SAR) consists of a 5-metre-wide strip of bare soil, completely cleared of munitions and free of vegetation. The outer firebreak must constantly be kept clear of encroaching vegetation by suitable means. Trees have been removed in a 9-metre-wide buffer left and right of the outer firebreak using harvesters with the corresponding reach.
- The first inner firebreak (1. IR) consists of a 3-metre-wide strip of bare soil free of vegetation. The first inner firebreak must constantly be kept clear of encroaching vegetation. It is not to be cleared of munitions. Trees have been removed in a 9-metre-wide buffer on either side. There is consequently an 18-metre-wide treeless strip between the outer firebreak and the first inner firebreak.
- The second inner firebreak (2. IR) lies 120 metres from the first inner firebreak. It has the same form (bare soil, 3 metres wide) and the same maintenance requirements. In the 120-metre-wide strip between the two inner rings, there are only isolated trees, as the vast majority have been removed using armoured machinery.
- The interior roads (IW) are already in place and are needed for munitions clearance. They must be kept permanently clear of vegetation. Accordingly, they must be cleared of munitions and maintained on a permanent basis. Trees have been removed from a 9-metre-wide buffer left and right of the interior roads.
- As needed, additional firebreaks (SL) can be created to supplement the above fire containment elements. Trees must be cleared from a 9-metre-wide buffer on either side. With the additional firebreaks positioned 18 metres from interior roads, this leaves the intervening space free of trees. Additional firebreaks must be established and maintained as strips of bare soil.



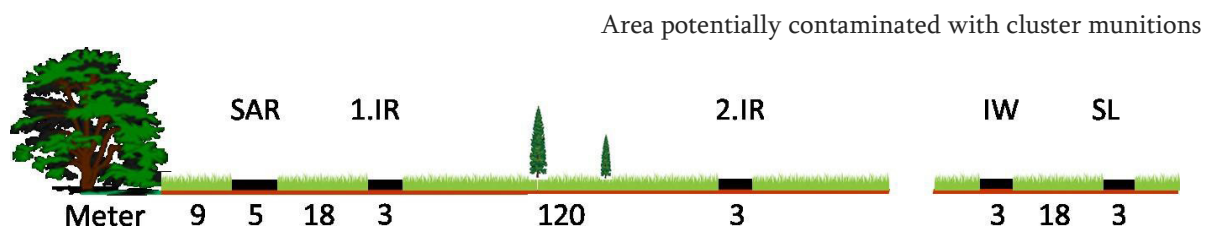


Figure 7: Schematic diagram of the fire safety and containment system around the area potentially contaminated with cluster munitions. Distances in meters. Abbreviations:  
 SAR = *Sicherungsaußenring*, outer firebreak; 1. IR = *erster Innenring*, first inner firebreak;  
 2. IR = *zweiter Innenring*, second inner firebreak; IW = *Innenwege*, interior roads;  
 SL = *Sicherungslinien*, additional firebreaks.

Figure 8 shows the fire containment system and its position. The outer and inner firebreaks almost completely surround the area potentially contaminated with cluster munitions. Only small parts of its eastern and western fringes remain outside because they are located in high forest unsuitable for controlled burning. However, clearance using the detectors specified above is possible in these areas during the winter season.

The interior roads cross the area multiple times.

The various firebreaks have a total length of 66,579 metres, made up as follows:

- outer firebreak 18,496 m
- first inner firebreak 18,846 m
- second inner firebreak 15,861 m
- interior roads 12,662 m
- additional firebreaks 714 m

This fire containment infrastructure surrounding the area potentially contaminated with cluster munitions is complemented by the additional 90-kilometre fire containment system around periphery of the site. Because of the contamination with large-calibre ordnance, the various firebreaks were created by a specialist contractor using an unmanned, remote-controlled caterpillar in 2016. The intended firebreaks were first checked visually using drones to determine the best routes for them within the landscape. For safety reasons, a distance of 1,000 metres was maintained between caterpillar and operator. In addition, the whole area of operations had been secured by means of remotely monitored barriers (figures 9 to 11).

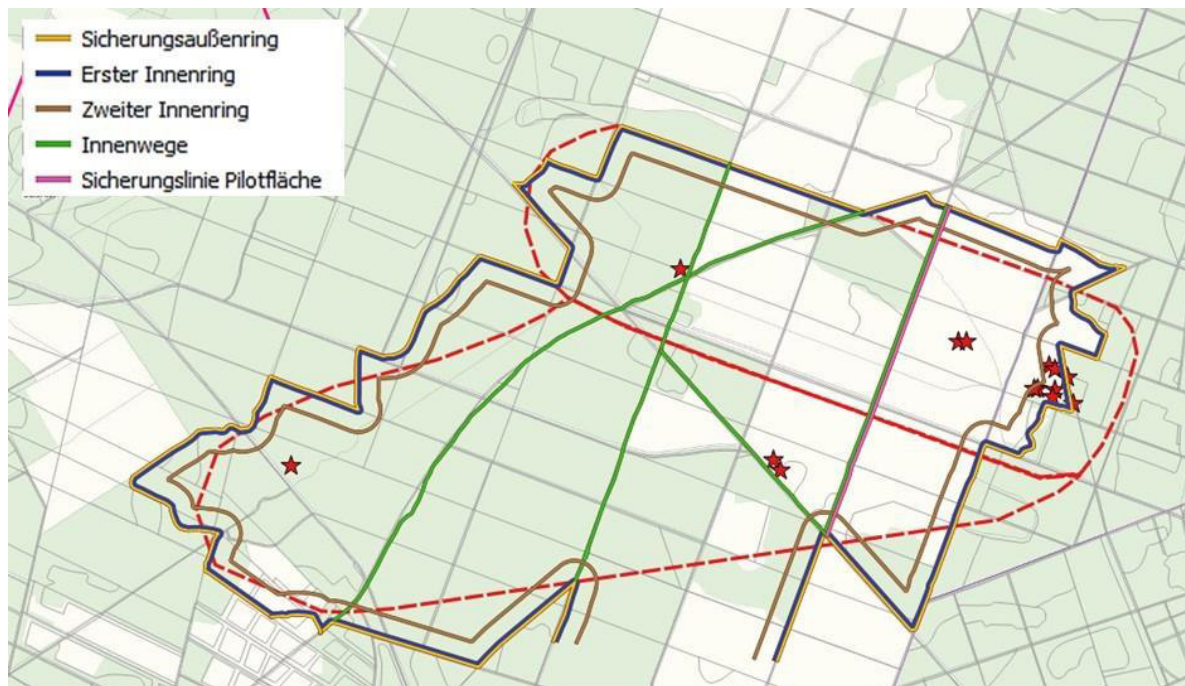


Figure 8: Position of the fire containment system designed by the Federal Forestry Service, also showing the locations of ShOAB-0.5 finds pre-dating the start of the clearance campaign. For further explanations, see text; for key, see figure 7.



Figure 9: Unmanned, remote-controlled caterpillar used to create the firebreaks for the fire containment system. For further explanations, see text.



Figure 10: Workplace of the operator of the unmanned, remote-controlled caterpillar, showing wireless transmission system and trailer housing a generator. For further explanations, see text.



Figure 11: Firebreak created by remote-controlled caterpillar. For further explanations, see text.

## 7. CONTROLLED BURNING OF VEGETATION

The controlled burning of selected sectors inside the potentially contaminated area started in 2017, to be continued in sections thereafter on an annual basis. For reasons of conservation and clearance planning, no more than around 200 hectares can be burned each year (see subsection 3.7). That value is determined by the clearance rate achieved each year.

Burned areas are incorporated into the clearance programme as permitted by overall clearance planning. Burned areas should be cleared in the second year following burning, at the latest. Otherwise, depending on the composition and density of the vegetation and meteorological conditions (drought/precipitation), there is a risk that regrowth will be so strong as to render clearance significantly more difficult or even impossible.

Controlled burning itself demands very specific meteorological conditions to ensure that the fire can be kept under control. In general terms, it requires dry and cool or cold weather over several days, or preferably over a week or more. Depending on the position of the area to be burned, the wind must moreover be coming from the right direction to drive the fire away from critical areas and anywhere requiring protection and into the area intended for burning. The various conditions must be favourable in their entirety, all at the same time. The required meteorological conditions are typically only met on a few days each year, usually in February or March and rarely in October or November. Controlled burning proved possible from 2017 to 2022. 2023 was the first year in which suitable weather conditions never arose, with the result that controlled burning could not take place (see subsection 10.4 for the possible consequences)

For controlled burning, the area is cordoned off with a safety buffer of at least 1,000 m (often 2,000 m or more) surrounding the area to be burned. The fire is lit on edges which have previously been cleared of munitions. The personnel performing that task then withdraw and do not return to the area for the next 24 hours.

The fire is monitored – wherever possible – using video and drone technology.

For some visual impressions of controlled burning and a map of the areas burned between 2017 and 2022, see figures 12 to 14.



Figure 12: Controlled burning of heath. For further explanations, see text.



Figure 13: An area after controlled burning. For further explanations, see text.

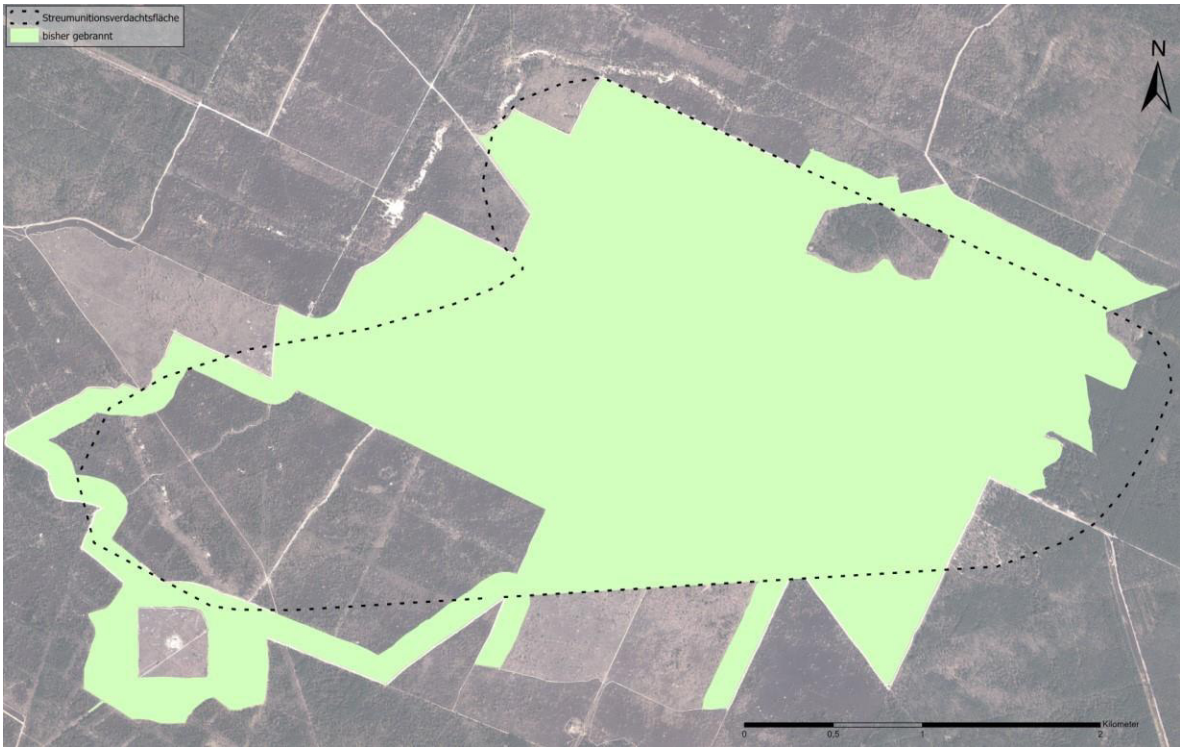


Figure 14: The areas subjected to controlled burning from 2017 to 2022. For further explanations, see text.

## 8. MUNITIONS CLEARANCE: GENERAL PROCEDURE

### 8.1. PROCEDURE IN AREAS WITH NORMAL CONTAMINATION LEVELS

The whole area to be cleared has been divided into plots of 50 x 50 m. Each plot is searched using Minelab F-3 UXO detectors in accordance with the manual clearance procedure (for full-area, selectively sub-surface clearance). Key points and evacuation routes are marked out with wooden stakes to ensure that the plots are processed in their entirety. All finds of cluster munitions are surveyed in situ using GPS, given a consecutive ID number and so documented without risk of confusion. All other munitions are identified, cleared and documented plot by plot. Once clearance is complete, the on-site supervising engineers conduct spot checks (figure 15).

Anomalies that are too deep for manual recovery are marked and later – once the plot in question has been cleared of munitions on or near the surface – uncovered, identified and recovered using an excavator.

This work is only conducted in areas that have been subjected to controlled burning. For small areas with a lot of vegetation which cannot be burned to the required degree, the method is adapted to the particular situation. For example, relatively small groups of trees are frequently found in which a vigorous undergrowth of ferns and blueberry bushes develops during the summer months. Unsuitable to controlled burning, these islands of vegetation are cleared during winter, when the undergrowth has died back naturally.

The destruction of cluster munitions is undertaken periodically by the munitions-disposal agency KMBD Brandenburg, by means of in-situ controlled explosions where safety concerns make transport impossible (figure 16). The remaining cleared munitions are relocated to decentralised bases and properly destroyed there or are destroyed at a local demolition range (see subsection 8.3).



Figure 15: Elements of clearance work: (top row, left to right) plots staked out; anomalies flagged up; a find on the surface; (bottom row) operating the Minelab F-3 UXO detector and digging down towards anomalies



Figure 16: Cluster munitions (in this case, ZAB-2.5M submunitions) prepared for destruction by open detonation (top) and open detonation of cluster munitions (bottom)



## 8.2. PROCEDURE IN AREAS WITH ESPECIALLY HIGH CONTAMINATION LEVELS

As the work of munitions clearance has progressed, patches of ground have been found which contain such a high density of anomalies as to rule out purely manual clearance as described in subsection 8.1. Such areas occur most commonly in and around former impact areas and mock targets.

An area is classified as having an especially high level of contamination if a pair of clearance operatives achieves a clearance rate of less than 30 m<sup>2</sup>/day (equivalent to a clearance area for two people of around 5.5 x 5.5 m).

Such areas are processed using a combination of manual, selective clearance and mechanical volume clearance. First, all large munitions are cleared manually in accordance with the procedure outlined in subsection 8.1. Large munitions are defined as any piece of ordnance with a net explosive weight of more than 100g.

Once cleared of large munitions, these areas are processed with a screening bucket mounted on an excavator. The soil is lifted, and all objects no smaller than the minimum size of a ShOAB-0.5 submunition are separated out (see figure 17).

The operators work inside a protected cab, the safety features of which (armoured glass and steel plates) are designed to withstand an explosive weight of 100g.

The work is supervised by a licensed person via video (see figure 18). The supervisor is located far enough away to guarantee their safety. They have an emergency stop switch that can be used to halt the operation of the screening bucket with immediate effect.



Figure 17: Screening bucket in operation. One of the monitoring cameras can be seen on the arm of the excavator.



Figure 18: Video monitoring of the operation of a screening bucket



Figure 19: Clearance area following full-area processing using screening buckets

Areas cleared by those methods are left bare of all vegetation (see figure 19). That fact is the subject of consultations with the conservation authorities. The conservation authorities limit the proportion of land within the Wittstock site that is without vegetation with reference to local conditions and ecosystems.

### 8.3. DESTRUCTION OF MUNITIONS

All munitions and components thereof must be handed over to the munitions-disposal agency in accordance with German law.

Munitions considered safe to handle and transport are relocated to one of two decentralised bases, where they are sorted and made available for safe destruction by the public munitions-disposal agency of *Land Brandenburg*.

Munitions that cannot be transported on public roads are destroyed by detonation in specially installed demolition ranges. One such demolition range is used to destroy small-calibre munitions. Another, consisting of several demolition pits, has been installed for detonating munitions of various calibres. The munitions can be destroyed separately there. The demolition ranges have been surrounded by their own fire

containment systems, to prevent adverse consequences for nearby areas.

Munitions deemed unsafe to handle and transport are detonated in situ.

## 8.4. DOCUMENTATION

All finds are documented unmistakably and in detail. They are divided into categories as follows:

- Scrap: Number of pieces, tonnage and general description
- Ordnance not including cluster munitions: Unique ID for each object and the circumstances of the find, using the documentation sheet under the federal guidelines for munitions clearance
- Cluster munition remnants: In addition to the data recorded for other ordnance, each find is individually tracked from discovery to disposal by means of an unmistakable and unique number; where legible, markings (lot, production year, etc.) are recorded. Using surveying methods, the exact location of each find is recorded to the nearest 0.1 m.

Fundkarte Räumung Streumunition Liegenschaft Wittstock Nr. **000746**

Funddatum, Uhrzeit	12.07.2018	12:20 Uhr
Typ	ShOAB-0.5	
Beschriftung	80-2-75 / TG-30 / 56-79	
Tiefe uGOK	0,10m	
Forstabt. / Teilfläche	Dünamünde	
R WGS84 UTM33N	342959,3	H WGS84 UTM33N 5885116,3
Detektiert mit	F3 UXO	
Dateiname Foto	Streumunition_0746.jpg	
Truppf. §20 SprengG	L. Fischer	
Unterschrift	Jan Fischer	
Bestätigung AG / öBÜ	B	




Figure 20: Documentation for find Red 746, a ShOAB-0.5 submunition

## 8.5. QUALITY CONTROL

The clearance conducted by commercial EOD contractors is subject to intensive, independent quality control.

The objective of the clearance campaign is to dispose of all ordnance and other ferromagnetic anomalies that are the size of a ShOAB-0.5 or larger. That clearance objective is defined by certain criteria (figure 21):

- For any ferromagnetic anomaly still present, the sum of its three dimensions (X+Y+Z) must not exceed 25 cm, the circumference of a ShOAB-0.5.
- Test objects with similar detection characteristics to the ShOAB-0.5, buried in randomly selected plots prior to clearance work, must all have been found in the course of that work.

Once subjected to internal quality control by the contractor, each plot is then independently checked for achievement of the clearance objective by external project supervisors. That verification takes the form of spot checks covering 10-20% of each plot. If one or more objects exceeding the 25 cm criterion are found, the plot in question is not accepted as cleared. The commercial clearance contractor must then repeat the full-area clearance of the plot. This is followed by another round of quality control.



Figure 21: Objects of the minimum size to be detected (left) and a test object used to check the effectiveness of clearance work (right)

## 9. MUNITIONS CLEARANCE: PROGRESS MADE UP TO AUGUST 2023

After extensive preliminary work (see sections 5, 6 and 7), the actual clearing of the area potentially contaminated with cluster munitions began in March 2017.

### 9.1. CLEARED AREA

Clearance progress achieved between the start of clearance proper in March 2017 and the end of August 2023 is as follows:

Total surface area potentially contaminated with cluster munitions:	11,000,000 m <sup>2</sup>
Cleared portion of area potentially contaminated with cluster munitions:	6,267,900 m <sup>2</sup>
Remaining area to be cleared:	4,732,100 m <sup>2</sup>

Outside the area potentially contaminated with cluster munitions, 921,500 m<sup>2</sup> had to be cleared for fire safety purposes or for access and evacuation routes.

Clearance progress between March 2017 and August 2023 thus totalled 7,189,300 m<sup>2</sup>, of which 6,270,900 m<sup>2</sup> was achieved within the area potentially contaminated with cluster munitions.. Progress on clearing munitions was recorded for each year as follows (figures have been rounded):

Year	Progress in m <sup>2</sup>			
	Within potentially contaminated area		Outside potentially contaminated area	
	Progress that year	Running total	Progress that year	Running total
2017	470,000	470,000	0	0
2018	764,000	1,234,000	218,000	218,000
2019	1,210,000	2,444,000	140,000	358,000
2020	1,086,000	3,530,000	112,000	470,000
2021	850,600	4,380,600	301,900	771,900
2022	1,339,200	5,719,800	149,600	921,500
Jan.-Aug. 2023	548,100	6,267,900	0	921,500

The areas cleared by the end of August 2023 are shown in figure 22.

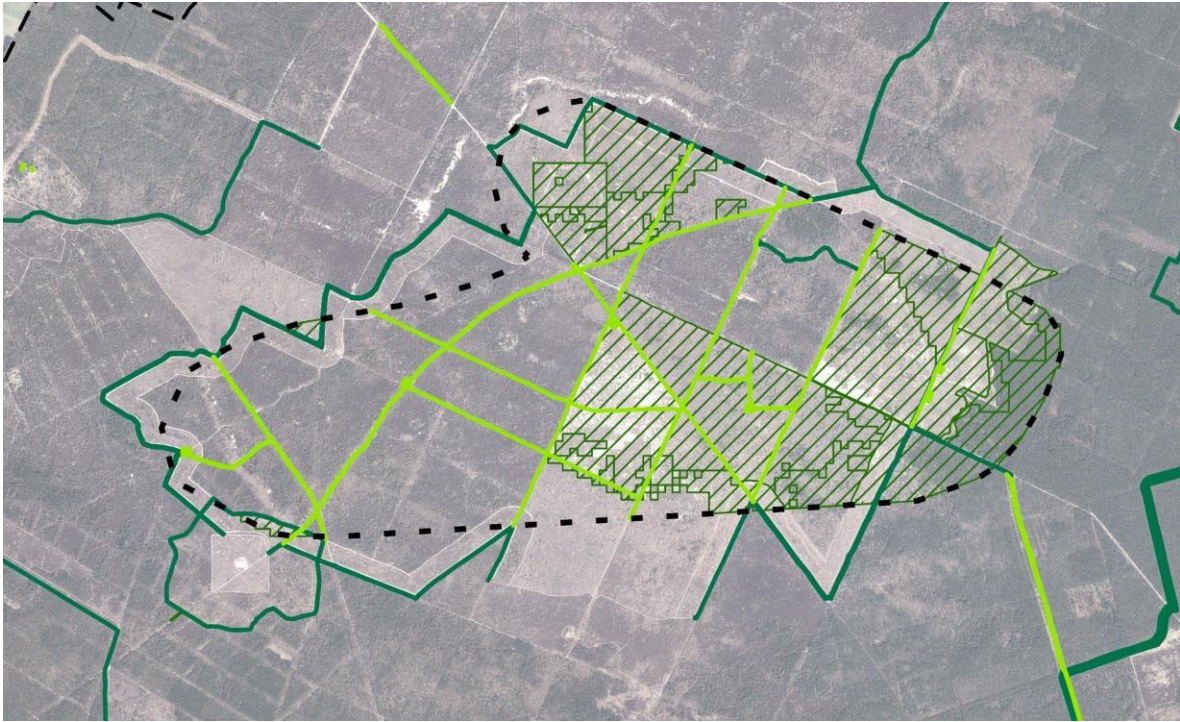


Figure 22: Areas cleared of cluster munitions by the end of August 2023 (green cross-hatching); cleared roads (lime green) and firebreaks (dark green). More cleared roads and firebreaks lie beyond the confines of this map.



## 9.2. FINDS

Between the start of clearance proper in March 2017 and the end of August 2023, the following cluster munitions were found, recovered and destroyed by detonation:

Type	Quantity	Percentage of total
AO-1 SCh	295	4.3
AO-1 M	5	0.1
AO-2.5	2	0
AO-2.5RTM	118	1.7
AO-10 SCh	25	0.4
ShOAB-0.5	4,116	60.1
PTAB 1	275	4
PTAB-1 M	32	0.5
PTAB-2.5-1.5	1	0
PTAB-2.5 M	978	14.3
PTAB 2.5 TG	23	0.3
PTAB-10-5	133	1.9
ZAB 1-E	1	0
ZAB 2.5M	746	10.9
ZAB 2.5S	98	1.4
ZAB 2.5	2	0
Total:	6,850	

The penetration depth at which the ShOAB-0.5s have been found varies between 0 cm and 30 cm below ground level. The average depth is just under 15 cm. Penetration depths are thus in line with expectations. Some of the PTAB-2.5Ms, AO-1 SChs and others found were at depths of up to 65 cm below ground level. The detectability of these cluster munitions was checked and confirmed by trials in the field. The strategy described above (see section 4) is therefore also suitable for those types of cluster munitions.

Only around 5% of the finds detected, checked and cleared are cluster munitions. The area potentially contaminated with cluster munitions is highly contaminated with other types of ordnance. Since 2017, 138,964 pieces of other ordnance have been found (not including scrap from equipment): artillery and armour-piercing shells, anti-tank missiles, rockets and bombs weighing up to 500 kg (see figure 27). A large proportion of those munitions have operational fuses and explosive charges, so all munitions found must be thoroughly assessed in terms of potential risk and, consequently, handling safety and disposal options.

Munitions fragments with or without deposits of explosives are not counted individually, because of their abundance. Their total tonnage has reached approximately 210,000 kg (210 t) since March 2017.

The total tonnage of scrap originating not from munitions but from equipment etc. has reached 2,065,000 kg (2,065 t) since March 2017.

The vast majority of munitions fragments and other scrap weigh a few hundreds grams each. Larger pieces, like the remains of an MI-6 helicopter shown in figure 23, are the exception.



Figure 23: The remains of an MI-6 transport helicopter

### 9.3. PERSONNEL

Since March 2017, various companies specialising in EOD have been entrusted with the work (search, uncovering, identification, recovery and preparation for destruction and disposal by KMBD Brandenburg). Their contractual obligations were based on Europe-wide public procurement procedures.

Work began in March 2017 with one specialist contractor and 17 people. The personnel increased thereafter from year to year. There are currently two companies working at the clearance site. Average personnel numbers since 2017 are as follows:

2017	37 people
2018	98 people
2019	111 people
2020	122 people
2021	161 people
2022	212 people
2023	190 people (as at end of August 2023)

The reduction in personnel seen in 2023 is due to the fact that one of the three EOD companies used up to the end of 2022 has withdrawn from clearance work. The associated reduction in personnel has been partly offset by increases in personnel on the part of the other two EOD companies. (On the develop of personnel numbers, see also subsection 10.3.)

The following factors hindered the personnel numbers intended for Wittstock from being achieved early on and maintained:

- The responsible individuals need to have the licence required by federal law for dealing with munitions. Licences are only issued following special training and an official exam. As a result, the number of licence holders in Germany is relatively low.
- Because of vigorous growth in the building sector, demand for EOD personnel has been high, which has led to competition between the various projects.
- The low population density of the area (Ostprognitz being one of the five districts with the lowest population density in Germany), it is difficult to find licensed personnel who are based locally.
- Simultaneously, the remote location makes it hard to attract qualified EOD personnel from other parts of Germany to work at Wittstock.
- To guarantee reliable and clear communication in the context of hazard-prone tasks, command of the German language is essential. Scope for using non-German-speaking personnel is therefore significantly limited.

#### 9.4. CLEARANCE RATE PER PERSON

As described above, the degree of contamination with munitions and other anomalies has kept rising in the areas cleared over recent years. This has been associated with a reduction in the surface area cleared per person deployed:

Area cleared per person (on the basis of 220 working days)

Year	Within potentially contaminated area			Outside potentially contaminated area	
	No of people	Total progress for the year (m <sup>2</sup> )	Progress per person per day (m <sup>2</sup> )	Total progress for the year (m <sup>2</sup> )	Progress per person per day (m <sup>2</sup> )
2017	37	470,000	58	0	0
2018	98	764,000	35	218,000	28
2019	111	1,210,000	50	140,000	13
2020	122	1,086,000	40	112,000	13
2021	161	850,600	24	301,900	57
2022	212	1,339,200	29	149,600	24
Jan.-Aug. 2023	190	548,100	19	0	0

Alongside the actual EOD personnel, their supervisors, documenters and clearance-site management, the work to clear munitions occupies project coordinators from the Federal Forestry Service and its consultants as well as on-site project supervisors, a security team and the public munitions-disposal agency.

## 9.5. EQUIPMENT

Clearance work is supported by excavators of various sizes and wheeled loaders. In 2023, a total of six wheeled excavators with screening buckets and video-monitoring systems are in operation.

## 9.6. ANCILLARY FACILITIES

For the purposes of the clearance campaign, construction-site facilities are maintained in two separate locations, with containers housing office and meeting space, break-out areas, sanitary facilities (toilets, showers) and medical provision. Energy supplies are currently still assured by means of generators. Plans are being made to replace the generators with photovoltaic systems.

In the vicinity of clearance operations, personnel have access to break-out areas and sanitation. In all areas where work is carried out, boxes for emergency care in the event of accidents are positioned on a decentralised basis.

Two specially equipped bases are maintained for sorting munitions and preparing them for removal by KMBD Brandenburg. The bases are guarded separately and located at a distance from the other construction-site facilities.

The construction-site facilities, bases and clearance areas have been connected by a network of roads. The main routes have been built to such a standard as to permit their use by the emergency services. Additionally, various helipads have been installed for emergency-response situations.

The whole network of roads has been completely cleared of munitions. Given the intensive use these unpaved roads need to stand up to (paving being impossible because they are in a special area of conservation), they require constant maintenance.

In particular, the intensive traffic caused by the personnel working in the clearance areas and the necessity of providing roads which the emergency services can use at all times make continuous maintenance and repair of the road network indispensable.

## 9.7. COSTS

As personnel numbers and equipment quantities have grown, the costs of clearance work have developed as

follows:

2017: EUR 1,628,000

2018: EUR 9,503,739

2019: EUR 11,523,802

2020: EUR 12,939,800

2021: EUR 21,386,571

2022: EUR 32,119,293

2023: EUR 22,140,614 (up to August 2023 inclusive)

Total for 2017 to August 2023: EUR 111,241,819

Alongside the costs of clearance work proper, these totals include the costs of project coordination and management, on-site project supervision, clearance-area security and the destruction of the munitions found.

## 9.8. ON-SITE PROJECT SUPERVISION

The technical EOD work is continuously monitored by a team of on-site project supervisors. Project supervision, which includes quality-control activities (see subsection 8.5), is assured by an external engineering firm. On-site project supervision occupies four people on a constant basis.

For reasons of procurement law, these services are the subject of a new Europe-wide procurement procedure in 2023.

## 9.9. OTHER ASPECTS

Outside working hours, the construction-site facilities and the munitions-storage facilities are guarded around the clock. This task is entrusted to a specialist security company.

For the economically disadvantaged communities surrounding the site, the cluster munitions clearance campaign has become an important factor in the local economy. Of particular note are the accommodation needs of personnel, food deliveries, various supply and disposal services, and other elements required for the work.

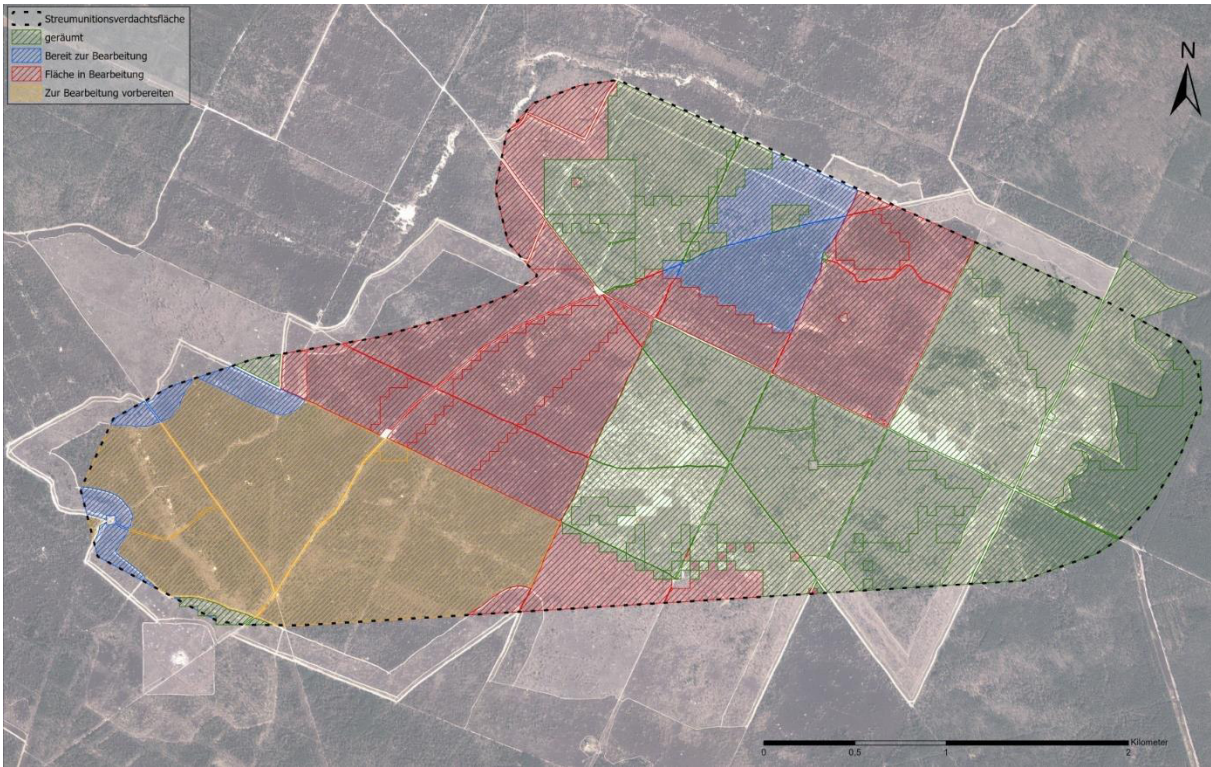


Figure 24: The areas completely cleared as of the end of August 2023 are shown in green. Areas currently being processed are red, those ready for processing are blue, while yellow signifies areas which still need to be burned in preparation for processing. For further explanations, see text.





Figure 25:

Some cluster munitions found by the end of October 2018:  
 (top left) AO-1 SCh, (top right) AO-10 SCh,  
 (center left) PTAB 2.5 M, (center right) PTAB  
 10-5, (bottom left:) ZAB 2.5M

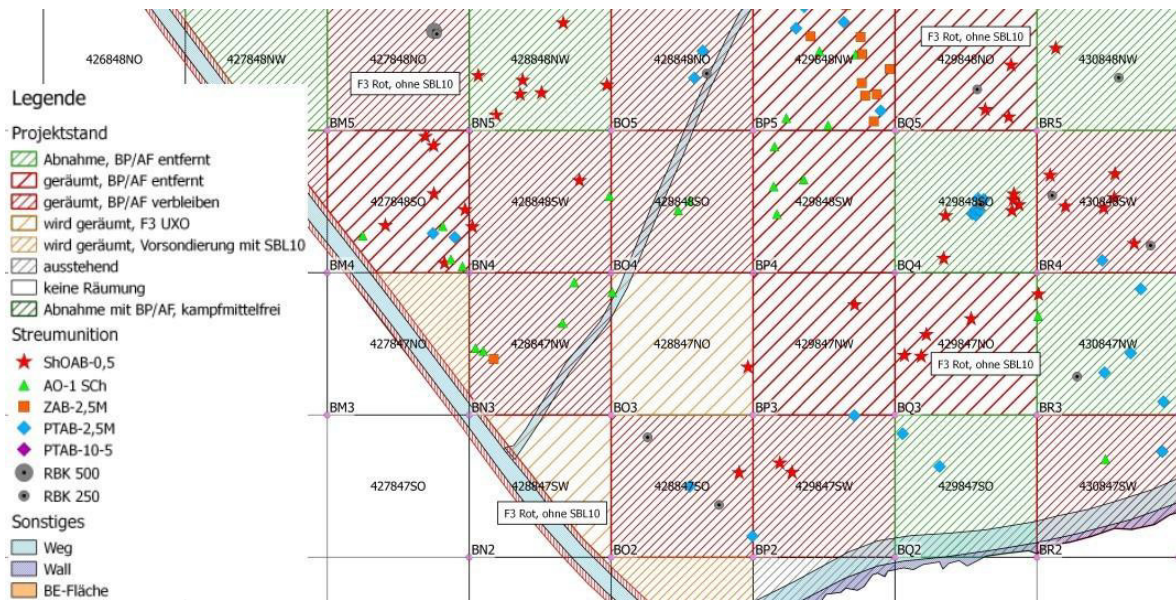


Figure 26: An example of the distribution of cluster munitions, including RBK-type cluster bomb containers. For further explanations, see text.



Figure 27: Other finds of munitions: artillery shells, missiles, fuses, etc. For further explanations, see text.



## 10. MUNITIONS CLEARANCE: FORWARD PLANNING

### 10.1. ASSUMPTIONS UNDERPINNING THE FIRST EXTENSION REQUEST IN 2018

In 2018, for the report accompanying the first extension request, the amount of time required for clearance was forecast on the basis of various assumptions. It also outlined potential risks.

At a clearance rate of 50-60 m<sup>2</sup>/person/day, as was aspired to at the time of the extension request, and with a staff of around 140 EOD personnel, the end of clearance work was estimated for 2024 or 2023.

The potential risk factors identified at the time were as follows:

- number of EOD personnel
- areas available after controlled burning
- degree of contamination with cluster munitions, other ordnance and scrap
- meteorological conditions

### 10.2. ACTUAL DEVELOPMENT OF CLEARANCE WORK SINCE 2018

The risks set out in the report accompanying the first extension request in 2019 have in part manifested themselves. Moreover, three more factors impeding clearance, which could not have been foreseen in 2018, have been added to the list of risks:

- number of EOD personnel
- areas available after controlled burning
- degree of contamination with cluster munitions, other ordnance and scrap
- meteorological conditions
- abundance of finds and necessary destruction work
- COVID-19 pandemic
- new procurement procedure for clearance work

These aspects are explained in more detail in the subsections below. The effects on the target clearance rate per person per day are explained in subsection 9.4 above.

### 10.3. NUMBER OF EOD PERSONNEL

In Germany, commercial munitions clearance contractors need to meet the requirements of the Explosives Act.

The commercial munitions clearance sector in Germany

- is characterised by numerous providers, most of them relatively small with a few dozen staff and the corresponding amount of equipment
- contains only a few larger companies with more than 100 employees and the relevant organisational, financial and technical background
- has around 1,800 to 2,000 individuals working in active EOD, with a large proportion of specialists tied

down by long-term framework agreements and therefore not available on the market.

The report accompanying the 2019 extension request specified a target personnel number of 140 people. As documented in subsection 9.3, that number proved impossible to attain until 2021, for the reasons set out above, but it has been clearly surpassed since. There are currently around 190 clearance personnel from two companies working at Wittstock. That increase has been achieved in spite of the shortage of licensed EOD technicians by means of intensive personnel-acquisition efforts.

The conditions described and the space available for EOD personnel, given the distances required between clearance teams for safety reasons, make it impossible to occupy more than approximately 190-200 people. This equates to about 13% of the EOD personnel active in the industry in the Germany.

The following factors also prevent any further increase in staffing levels:

- general shortage of specialists within the industry
- lack of available accommodation for EOD personnel close to the clearance site
- shrinking space within the clearance site, meaning a further staffing increase would make it impossible to maintain the necessary safety distance between clearance teams

Illness and resignations mean that a certain degree of fluctuation in personnel numbers is to be expected. In particular, the rate of possible resignations to take up posts elsewhere cannot be reliably estimated at the moment, given the competition for such specialist EOD personnel on the labour market.

It is to be expected that the shortage of personnel, in combination with the ever shrinking space available within the clearance site due to the necessary safety distance and the high contamination levels in the areas still to be cleared, will have an effect on personnel numbers and on the clearance rate in the coming years.

#### 10.4. AREAS AVAILABLE AFTER CONTROLLED BURNING

As described in section 4, the controlled burning of heath vegetation is a prerequisite for clearing areas of cluster munitions.

Despite the fire containment system in place, controlled burning is subject to strict limitations (see also section 7):

- Conservation requirements limit the annual amount of controlled burning to a maximum of 200 hectares.
- After the vegetation has grown back, burning cannot be repeated in the same area for a number of years. Therefore, the areas subjected to controlled burning must not significantly exceed what can be cleared within the next one or two years.
- For safety reasons, controlled burning can only be undertaken on a few days per year. In 2017, it was only possible on two separate days. If the particular weather conditions required do not occur, controlled burning is not possible – as has been the case in 2023.

In the course of 2023, the weather has not yet permitted controlled burning. The areas which have been burned and are therefore available for clearing will have been cleared by about mid-2024. If neither autumn 2023 nor spring 2024 provides an opportunity for controlled burning, this could lead to a significant drop in the clearance rate or even to a cessation of work.

These site-specific factors have recently been compounded by additional considerations:

- Numerous very large forest fires which struck other parts of Germany during the very dry summers of 2018 to 2022, some naturally occurring, some caused by human action or by munitions, have drawn the attention of fire services and the general public to the subject of forest fires. The deliberate burning of heath and woodland is seen with increasing scepticism both by the public and by the security and conservation authorities, especially in the context of the CO<sub>2</sub> emissions it causes.

Rigorous maintenance of the fire containment system, strict environmental and conservation measures, and continuous information campaigns and notification of the competent authorities and local communities, however, have made it possible to cement public approval regarding controlled burning at Wittstock.

There is no way to counteract adverse weather conditions.

The risk of adverse weather conditions that would prevent controlled burning and the associated ramifications for the continuation and/or completion date of cluster munitions clearance cannot be reliably assessed.

## 10.5. DEGREE OF CONTAMINATION

The data gained since 2018 testify to a very sharp increase in contamination with munitions and other anomalies towards the west and southwest – i.e. in the areas still to be cleared – to a level significantly higher than that of the areas cleared in 2017 and 2018. The actual degree of contamination, however, can only be established with certainty in the course of clearance work. Our assessments and estimates in respect of clearance rates are based on current values.

A higher or lower degree of contamination may result in lower or higher clearance rates and hence lengthen or shorten the duration of the clearance campaign.

The risk of a degree of contamination that diverges significantly from what is currently known and the associated ramifications for the continuation and/or completion date of cluster munitions clearance cannot be reliably assessed at this time. However, the findings described above do suggest that contamination levels will be higher in the areas still to be cleared and will lower the clearance rate per person per day accordingly. That risk cannot be reduced, as contamination levels are dictated by circumstance. The scope for countermeasures is further restricted by the safety distances and careful and conscientious procedures that are essential if the clearance objective is to be achieved and occupational safety guaranteed.

## 10.6. ABUNDANCE OF FINDS AND NECESSARY DESTRUCTION WORK

The abundance of finds is described in subsection 9.2. Destroying munitions by detonation is a sovereign function under German law, reserved to the munitions-disposal agency of the relevant *Land* (KMBD Brandenburg in the present case). Explosive demolition by others, such as EOD companies, is therefore not possible.

Only in part has the public munitions-disposal agency been able to destroy the increasing quantities of

munitions requiring detonation in a timely manner. Clearance rates have been reduced particularly by munitions that remained in the field, deemed unsafe for transport, and by the interruptions necessitated by more frequent detonations to ensure that safety distances were maintained.

Various steps have already been taken to increase the rate of destruction work:

- installation of additional demolition ranges
- shortening of transport routes
- establishment of explosives storage with specially suited mode of construction and particular safety features to avoid the need for time-consuming transport of explosives
- allocation of additional personnel from KMBD Brandenburg

## 10.7. COVID-19 PANDEMIC

The effects of the COVID-19 pandemic on clearance work were kept to a minimum thanks to extensive hygiene measures and strict monitoring thereof. The introduction of the disease to the clearance site by infected individuals and its subsequent spread there, which would have spelled comprehensive shut-down, was successfully avoided. What could not be avoided were staff absences caused by infections picked up elsewhere. The extensive hygiene measures (e.g. testing before entering the clearance site) also reduced the daily clearance rate to a certain extent.

## 10.8. METEOROLOGICAL CONDITIONS

The Wittstock region is already discernibly subject to the influence of the continental climate. This means its summer temperatures are higher and its winter temperatures lower than is usual in the rest of northern Germany.

In particular, low temperatures over extended periods during the winter, apart from the effects they have on personnel, can leave the ground frozen for several weeks. For safety reasons, munitions cannot be cleared under these conditions, as the use of force would be the only way of extracting them from frozen soil.

Unusually high temperatures in recent summers – up to 35°C in the shade and more than 45°C in the sun-drenched open areas where clearance work took place (and will take place in future) – resulted in longer breaks as prescribed by law and in a lower clearance rate.

Although woodland offers less extreme temperatures in both hot and cold weather and might therefore serve as an alternative target for clearance work during such times, there are now no areas of woodland left to be cleared.

Countermeasures against weather extremes are not possible.

The risk of adverse weather conditions and the associated ramifications for the continuation and/or completion date of cluster-munitions clearance cannot be reliably predicted.

## 10.9. NEW PROCUREMENT PROCEDURE FOR CLEARANCE WORK

Under the applicable provisions of procurement law, a new procurement procedure had to be conducted in respect of the clearance campaign in 2022. Work was consequently interrupted for a short time, and the clearance rate dropped for the first few weeks after the change of contract.

The applicable provisions of procurement law will make another procurement procedure necessary in 2025. This has to be a Europe-wide procedure. Its effects on clearance work can be expected to be similar to those of the previous procedure.

## 11. MUNITIONS CLEARANCE: OUTLOOK

### 11.1. CLEARANCE PLANNING AND SCHEDULE

The work to clear cluster munitions at the Wittstock site is subject to certain restrictions and risks which lie largely outside our control. The risk factors already identified in the report accompanying the 2019 extension request in relation to the duration of clearance work have not changed:

- number of EOD personnel
- areas available after controlled burning
- degree of contamination with cluster munitions, other ordnance and scrap
- meteorological conditions

These are compounded by risks arising from the

- abundance of finds and necessary destruction work

As a result of the very high levels of contamination with munitions and other anomalies in the areas still to be cleared and the shrinking space available for clearing munitions safely, the notional clearance rate is currently at around 20 m<sup>2</sup>/person/day.<sup>3</sup>

As outlined above, it is no longer possible, for space- and safety-related reasons, to further increase EOD personnel numbers. The expectation is that the personnel ceiling of 190 people can be maintained.

If the number of personnel does remain at 190, the annual clearance rate can be calculated as follows:

EOD personnel (effective)	190 people
Annual clearance time	45 weeks = 225 working days
Annual person-days	42,750 person-days/year
Average clearance rate	20 m <sup>2</sup> /person/day
Annual clearance rate	855,000 m <sup>2</sup> (85 hectares)/year
Remaining area to be cleared (as at end of August 2023)	4,732,100 m <sup>2</sup> (473 hectares)
Clearance time required for 473 hectares	approx. 5.6 years
Expected end of clearance proper (notice of completion)	early to mid-2029
Expected end of project as a whole (accounting, documentation, etc.)	early 2030

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<sup>3</sup> This is a notional value, as the calculation has to take into account all the personnel working on the site (including supervisors, clearance-site managers etc.).

Under the CCM, clearance is supposed to be completed by 31 July 2025. As will be evident from the outlook documented above, that deadline cannot realistically be met.

The current outlook cannot fully account for all the risks described above, since many of them, e.g. the opportunities for preparatory controlled burning or the actual density of contamination, cannot be foreseen and so cannot be influenced.

## 11.2. SCHEDULE

Based on the data and information currently available, the following project schedule is considered realistic (already completed work is included for clarity) (see also figure 28):

	Completed work
2011	Renunciation of military use, withdrawal of status as a military restricted area
2011	Adoption of a local by-law prohibiting public access to avert risks to public safety and order
2011/2012	Additional historical research, development of a strategic concept for the whole site
2013	Preparation of evacuation and access roads into the area potentially contaminated with cluster munitions: geomagnetic surveys of roads
2014/2015	Preparation of evacuation and access roads into the area potentially contaminated with cluster munitions: testbed surveys and clearance of roads
2015	Development of the concept, preliminary investigations and trials, public procurement procedure for the creation of the fire containment system
2016	Preparatory work, creation of the fire containment system, public procurement procedure for cluster-munitions clearance work in the area potentially contaminated with cluster munitions
2017	Survey and clearance of approx. 47 hectares, including trials for clearance methods specifically adapted to local conditions
2018	Clearance of the fire containment system to safeguard the necessary controlled burning, survey and clearance of approx 76.4 hectares
2019	Clearance of approx. 121 hectares
2020	Clearance of approx. 108.6 hectares
2021	Clearance of approx. 85 hectares
2022	Clearance of approx. 134 hectares

2023	Clearance of approx. 82 hectares
2024	Clearance of approx. 80-90 hectares
2025	Clearance of approx. 80-90 hectares
2026	Clearance of approx. 80-90 hectares
2027	Clearance of approx. 80-90 hectares
2028	Clearance of approx. 80-90 hectares
2029	Clearance of approx. 40-50 hectares
2030	Completion of final documentation on the work, end of the project

The areas to be cleared in any particular year cannot usefully be specified more exactly. Which areas are to be cleared depends largely on the opportunities arising each year for controlled burning, which in turn depends on weather conditions, and the location and size of the areas burned can only be controlled within certain parameters.

Continuous monitoring of targets will compare the plans to the actual clearance progress made. This will allow discrepancies to be recognised and suitable countermeasures to be taken.



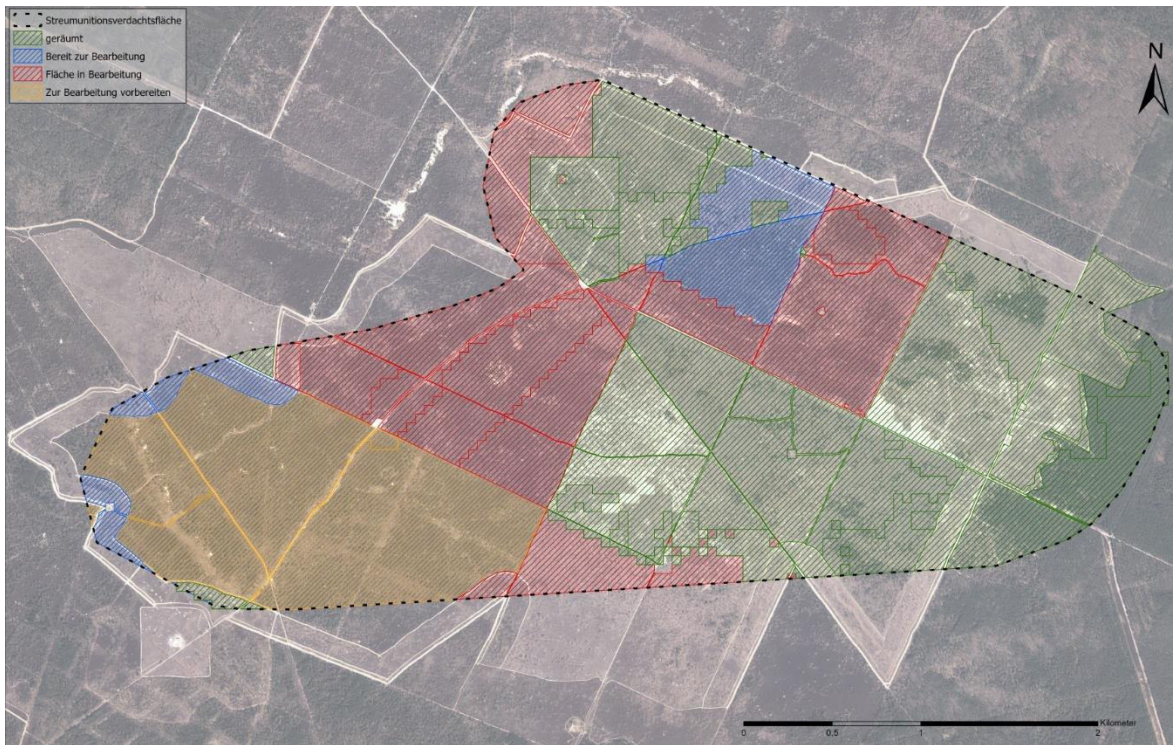


Figure 28: In 2023 and the subsequent years, cluster-munitions clearance will take place in the areas, shown in red, currently being processed and in those, shown in blue, ready for processing as a result of controlled burning. The areas shown in yellow can only be cleared once they have been burned. The green areas have already been cleared. For further explanations, see text.

## 12. COST ESTIMATE

Around EUR 110 million were spent on clearing the approx. 1,100-hectare potentially contaminated area up to the end of August 2023.

A total cost of around EUR 120 million is expected by the end of 2023. Average annual spending is currently forecast at around EUR 30 million. This expenditure chiefly comprises the costs of clearance by commercial contractors, engineering work and the destruction of munitions.

Assuming that costs remain constant, another approx. EUR 150 million will be required for 2024-2028. The costs of work remaining in 2029 is estimated at around EUR 15-20 million.

This would bring the total cost of clearing the area potentially contaminated with cluster munitions to approx. EUR 290 million. This differs considerably from the estimates made for the 2019 extension request, because

- the duration of the clearance campaign is significantly longer
- costs in general have risen significantly as a result of inflation
- personnel costs in particular have risen as a result of competition on the German labour market
- greater use of technology has become necessary

Engineering services account for around 5% of the total costs.

The necessary funding is assured by the Institute for Federal Real Estate.

## 13. CONSEQUENCES OF A LONGER CLEARANCE CAMPAIGN

Extending the duration of the clearance campaign can be expected to have the following effects:

- Humanitarian consequences
  - The site is not accessible to the public. No humanitarian consequences are expected.
- Socio-economic and economic consequences
  - The Wittstock site is uninhabited. Apart from forestry and conservation, the area is not used.
  - The clearance of munitions has created around 100 jobs in the communities immediately surrounding the site. This is a positive effect for what is a disadvantaged region. Extending the duration of the clearance campaign would increase the lifetime of those jobs accordingly.
  - All available accommodation in the vicinity of the site is permanently occupied as a result of the campaign. Clearance personnel use the local amenities to purchase groceries and other consumables, etc. This is already having a positive effect on the economic state of the otherwise disadvantaged region, which an extension to the clearance campaign would serve to maintain.
  - Overall, the socio-economic effects of extending the clearance campaign would be predominantly positive. No adverse effects are anticipated at this time.
- Environmental consequences
  - From an environmental perspective, the extension will be beneficial, as smaller areas being cleared each year can be expected to have less of a negative impact on the ecosystem.

## 14. REQUEST FOR EXTENSION

For the reasons described above and in accordance with Article 4(8) and (5) of the Convention on Cluster Munitions, the Federal Republic of Germany hereby requests the renewal of the extension granted to the deadline for completing the clearance and destruction of cluster munition remnants from the former Soviet military training area at Wittstock. The present extension request takes into account the requirements set out in Article 4(6) of the Convention.

