

Sustainable management of contaminated sites

Presentation 5.1
Phase 5 - Monitoring and Aftercare

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- When needed
- The objectives
- Monitoring
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When is monitoring & aftercare needed?

After the remediation of contaminated site is completed

And?

Residual contamination is left

Till?

The residual contamination is also remediated



The objectives

Sustain the remediation end-results

- To make sure that:
 - **Migration risks** from the residual contamination are contained
 - **Health risks** remain under control and gradually reduce
 - **Ecological risks** remain under control and gradually reduce
- To prove that the residual contamination is also remediated

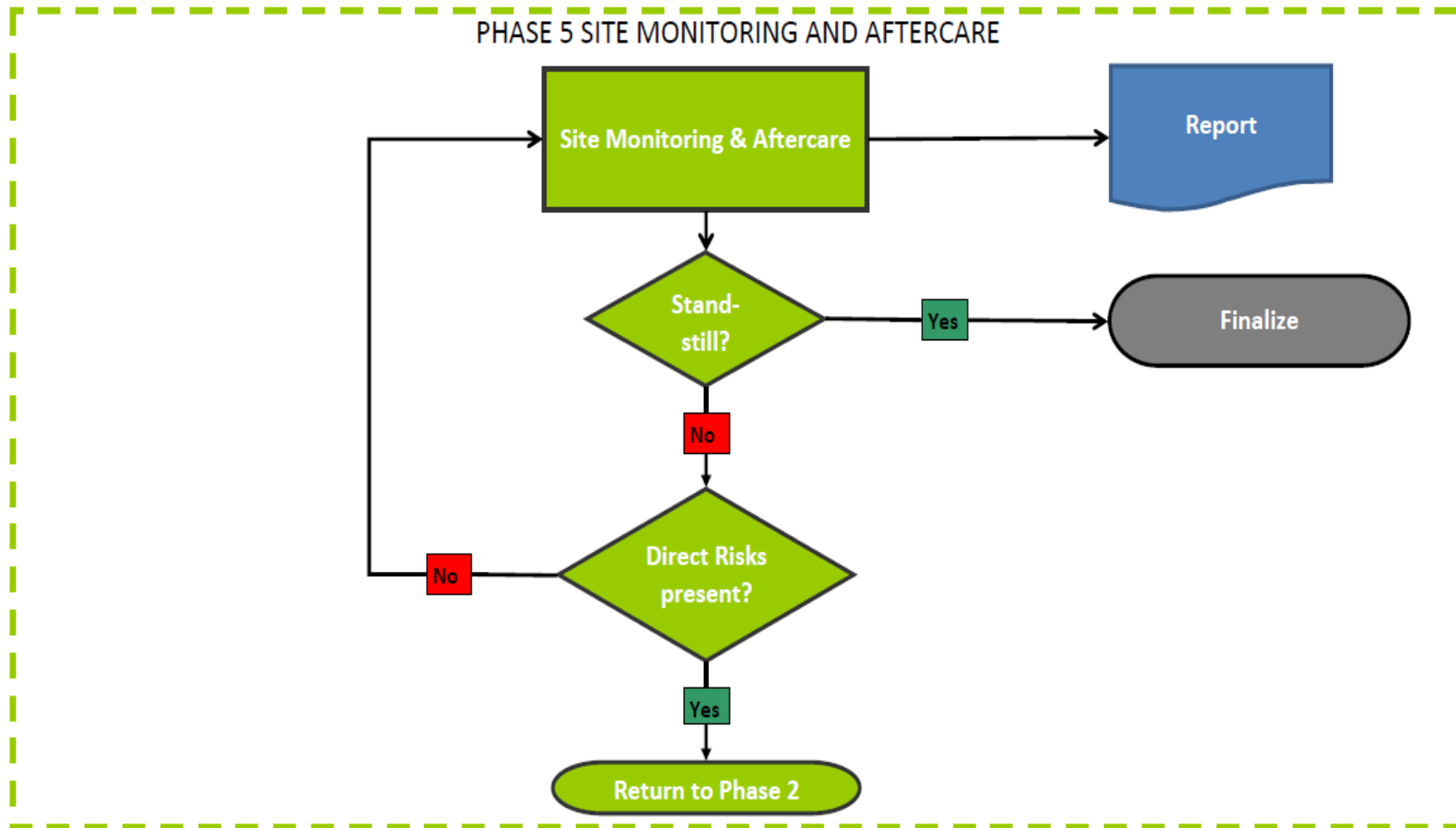


Measure, observe and document changes in the environmentally risk profile

- Recognize changes in the environmental impact
- Forecast possible developments
- Ensure adequate reactions in case of unexpected events
- Establish a standstill situation of the contamination in soil, bottom sediments and groundwater

- Technical support essential to sustain the remedial results by
 - Periodic technical inspections
 - Periodic technical services
 - Technical repairs in case unexpected breakdowns

Process Phase 5



Phase 1 Preliminary Site Assessment



Deliverables: Initial CSM - Preliminary Risk Assessment



Phase 2 Site Assessment



Deliverables: Gap Analyses ICSM – Investigation Plan - Improved CSM – Risk Assessment

Phase 3 Remediation assessment



Deliverable: Site remediation plan

Phase 4 Site remediation



Deliverable: Detailed remediation design – Evaluation – Update CSM – Management monitoring aftercare plan

Phase 5 Site monitoring maintenance & aftercare



Deliverable: Monitoring aftercare – periodical evaluation

What makes this Phase so different?

- Yearly financial requirements
- The technical input is limited
- Some tasks demand specialized input
- The time span is far longer than other phases
- Stakeholder involvement and awareness are crucial success factors



Monitoring tasks

- **Organizational**
 - Ensure that monitoring sampling is reliable
 - Ensure that monitoring is for the long term (years)
 - Make sure that enforcement of restricted site-use is institutionalized
 - Inform all relevant stakeholders
- **Technical**
 - Environmental sampling and sample analyses
 - Report and evaluate monitoring data
- **Financial**
 - Ensure yearly budget
 - Ensure yearly a provisional budget for unexpected events



Aftercare tasks

- **Organizational**

- Ensure that aftercare is carried out by a reliable partner
- Appoint a local focal point for site activities
- Ensure that aftercare is for the long-term (years)

- **Technical**

- Inspection all technical installations periodically
- Service all technical installations periodically
- Repairs any technical installation when broken

- **Financial**

- Ensure yearly budget for adequate aftercare
- Ensure yearly a provisional budget for unexpected events



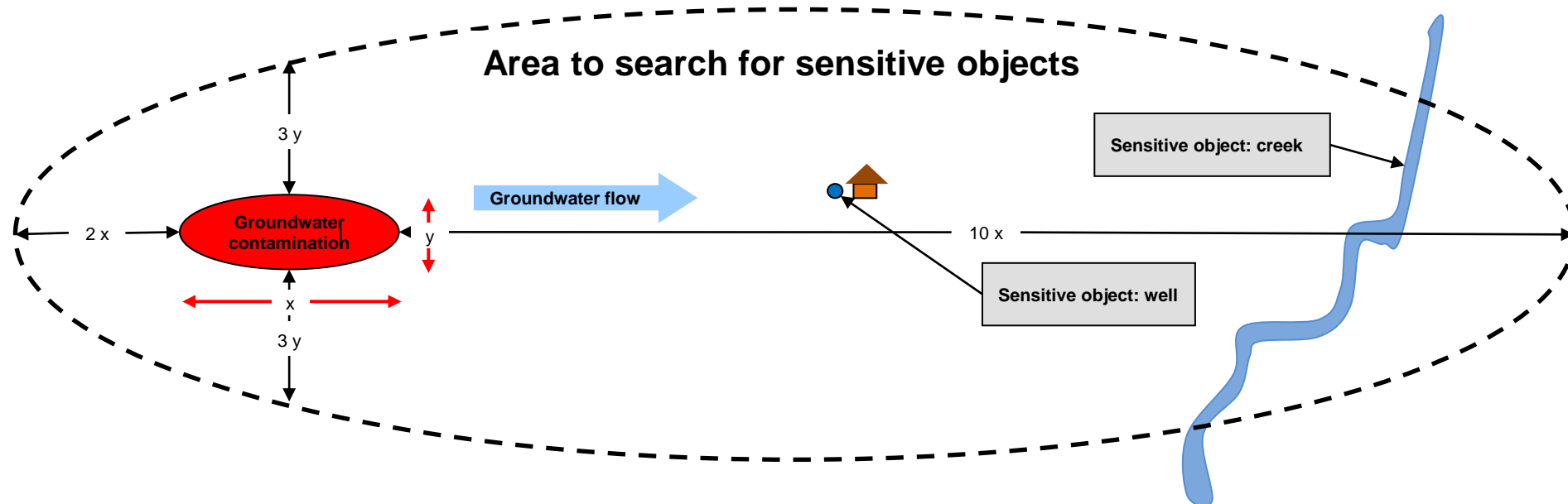
Monitoring and aftercare plan

Long term measure	Monitor	Points	
		Witness	Hold
Installed containment measures	Quality, location and function of installation	X	
	Safe behavior and proper use of PPE site staff	X	
Planted eucalyptus trees	Quality of seedlings	X	
	Loss of seedlings/trees	X	
	Density of planting	X	
	Safe behavior and proper use of PPE site staff	X	
Phyto-remediation of contaminated area	Recording effect of Phyto-remediation	X	
	Periodic soil sampling and analyses		X
	Periodic groundwater sampling and analyses		X
Awareness Stakeholders	Enforcement restricted site-use	X	
	Progress of stakeholder's involvement	X	

Monitoring plan site location map

Sensitive objects

- 10 times the length groundwater plume down gradient
- 2 times the length up gradient
- 3 times the width in a lateral direction

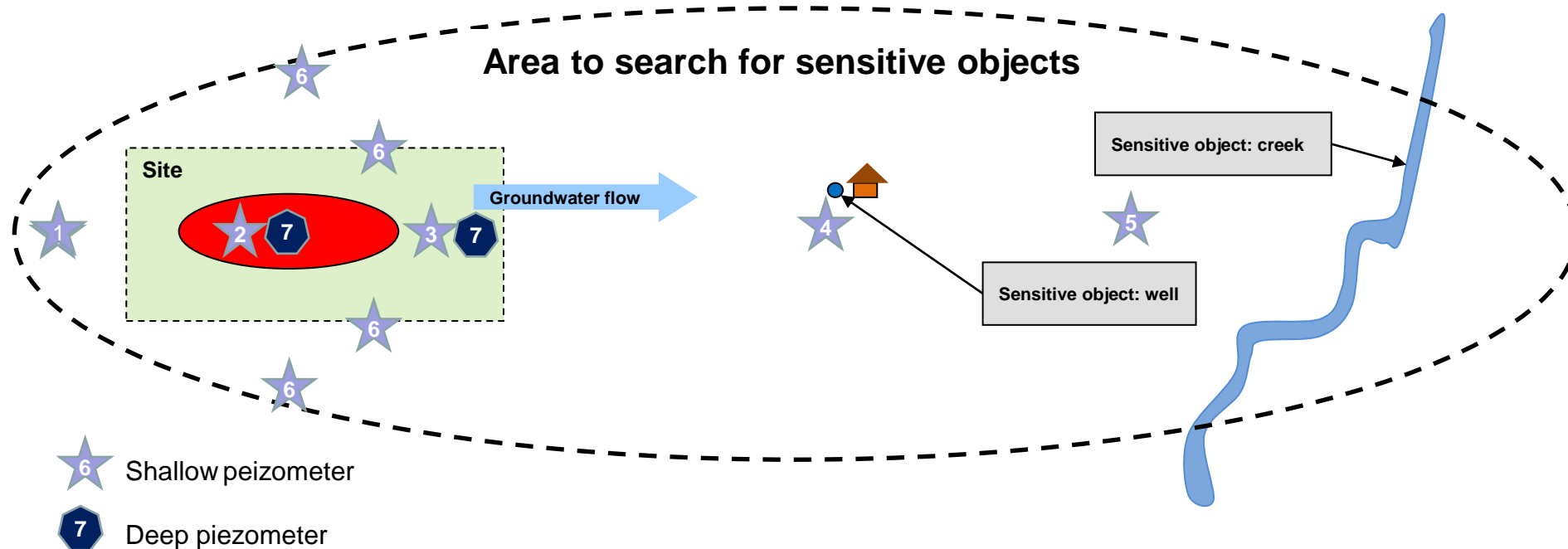


Monitoring network

- **Baseline:** Up-gradient groundwater plume
- **Centre:** The highest contaminant concentrations
- **Down-gradient:** The edge of the groundwater plume
- **Back-up:** Distance double the length plume
 - Monitor standstill
 - Un expected migration
- **Sensitive objects:** Between plume and sensitive objects



Groundwater monitoring layout



Monitoring and Aftercare organization

- **Accountable Party:** Final responsibility
- **Responsible Party:** Execution of Monitoring and Aftercare tasks
- **Consulted Party:** Have necessary information
- **Informed Party:** Should be informed

Site monitoring and aftercare report

1. Introduction

- Site history
- Phase 2 and 4 summary
- Residual contamination(s)

2. Monitoring and Aftercare

- Organization
- Objectives
- Requirements and interpretation
- Accountable, responsible, consulted and informed parties



Site monitoring report

3. Monitoring results

- Monitoring tasks
- Relevant monitoring locations
- Results and evaluation
- A decision model if and what steps are necessary

4. Aftercare results

- Aftercare tasks
- Relevant locations of the aftercare
- The site-use restrictions
- The results of the maintenance and aftercare
- The maintenance and substitution program



Site monitoring report

5. Conclusions and recommendations

Appendixes

1. Location of the site in a regional setting
2. Site layout map showing
3. Table characterizing the residue
4. Site layout map showing the sampling points
5. Analytical certificates of the sample analyzes



Questions?

