



Hungary-Slovakia-Romania-Ukraine
ENPI Cross-border Cooperation Programme

“2nd Phase of the project: „Starting Remediation”

Project number: HUSKROUA/1101/057

Cleaning works on LHK area, 2013-15
Работы по очистке участка ЛХК, 2013-15
Az LHK terület kármentesítése, 2013-15
Construction and operation
Строительство и эксплуатация
Építés és üzemelés

BI  CENTRUM LTD.

Velikiy Bychkiv, 8th December 2015.

The Programme is co-financed by the
European Union



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Drilling of production wells

Бурение эксплуатационных скважин

Talajvíz kitermelő kutak fúrása



Construction of drains Сооружение дрен Drének kialakítása



Mounting of water cleaning equipment
Монтаж водоочистного сооружения
A víztisztító berendezés szerelése

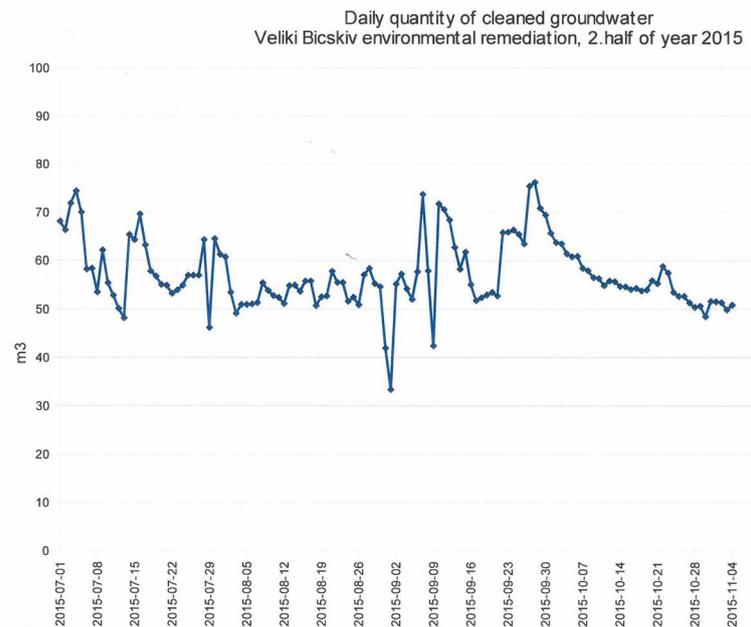


Mounting of pipelines, pumps and testing
Монтаж труб, насосов и тестовой период
Csövezés, szivattyú szerelés, próbaüzem



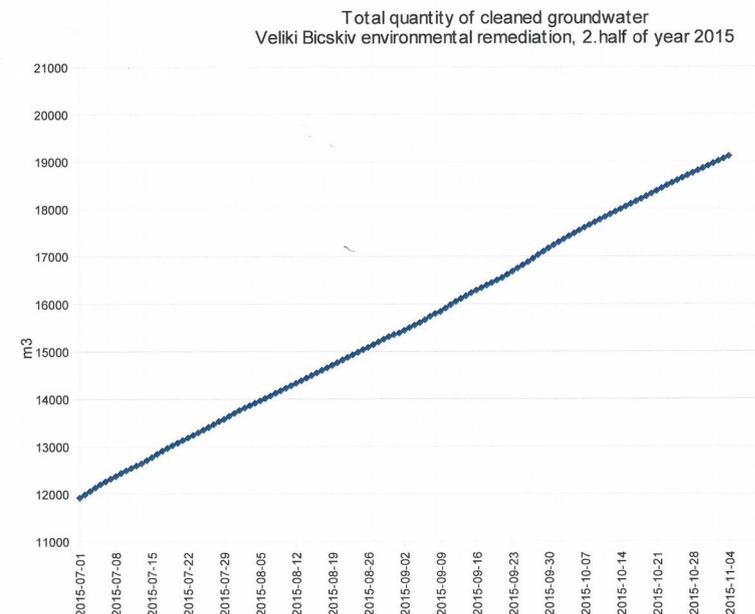


Continuous operation, 2015 Непрерывная эксплуатация, 2015 Folyamatos üzemelés, 2015



Daily quantity of cleaned water

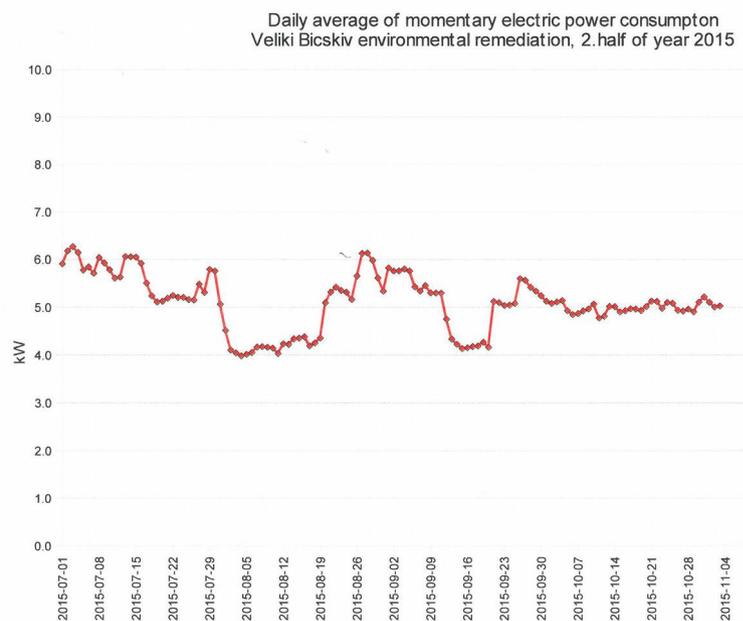
Summer: 60 m³/day
Winter: 50 m³/day



Total quantity of cleaned water

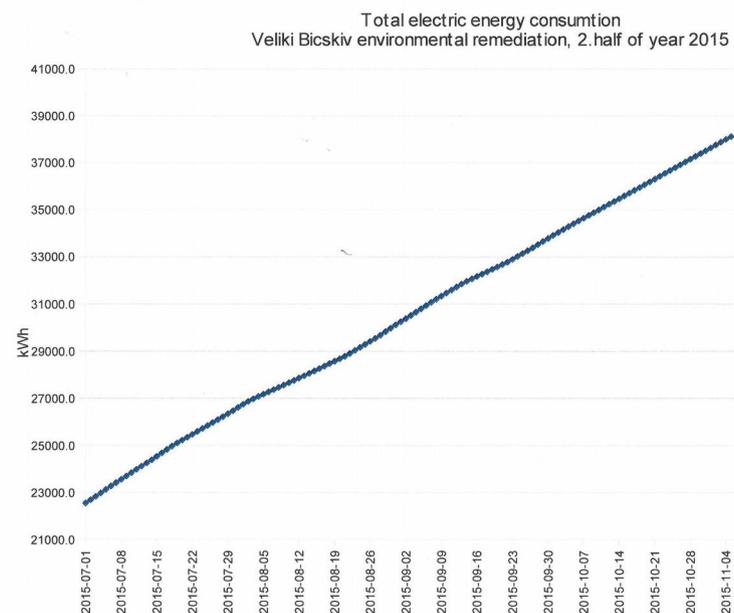
By 16th December 2015: 20000 m³

Continuous operation, 2015 Непрерывная эксплуатация, 2015 Folyamatos üzemelés, 2015



Daily electricity consumption

Average: 5 kW, max: 6 kW, min: 4 kW



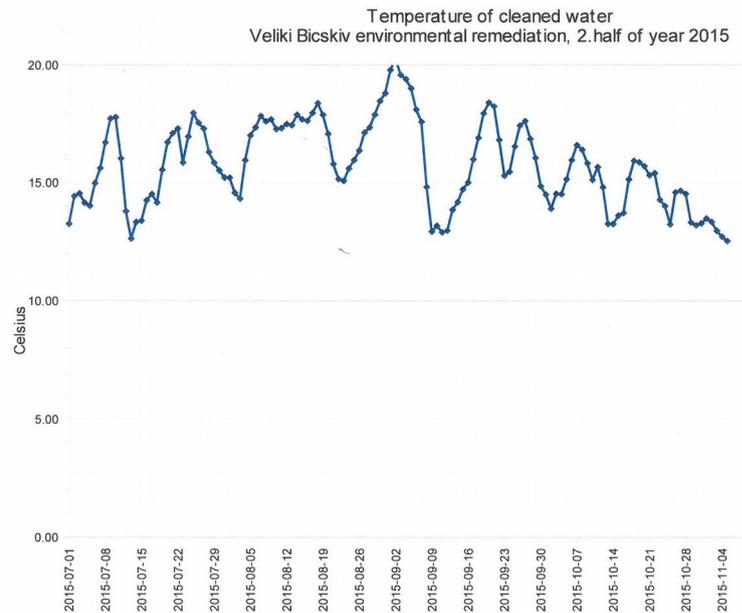
Total electricity consumption

By 16th December 2015: 38000 kWh

Continuous operation, 2015

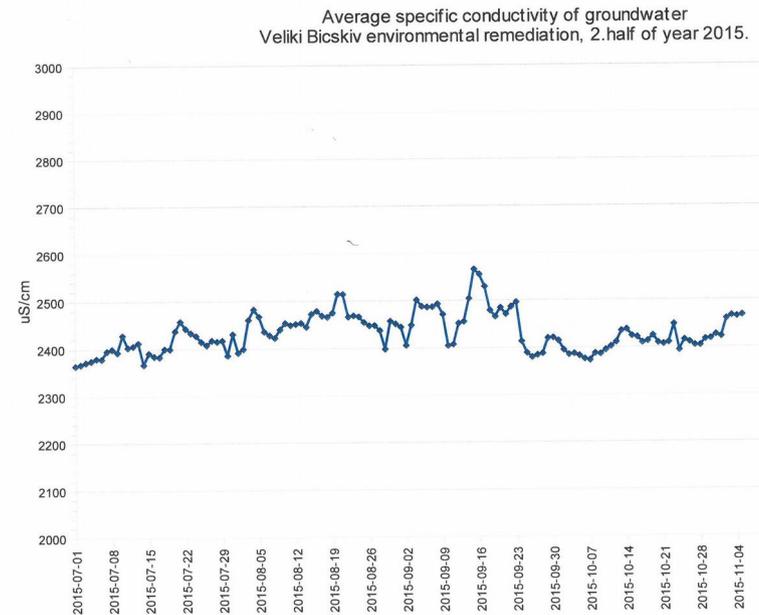
Непрерывная эксплуатация, 2015

Folyamatos üzemelés, 2015



Cleaned water temperature

Summer: over 15 °C
Winter: below 10 °C



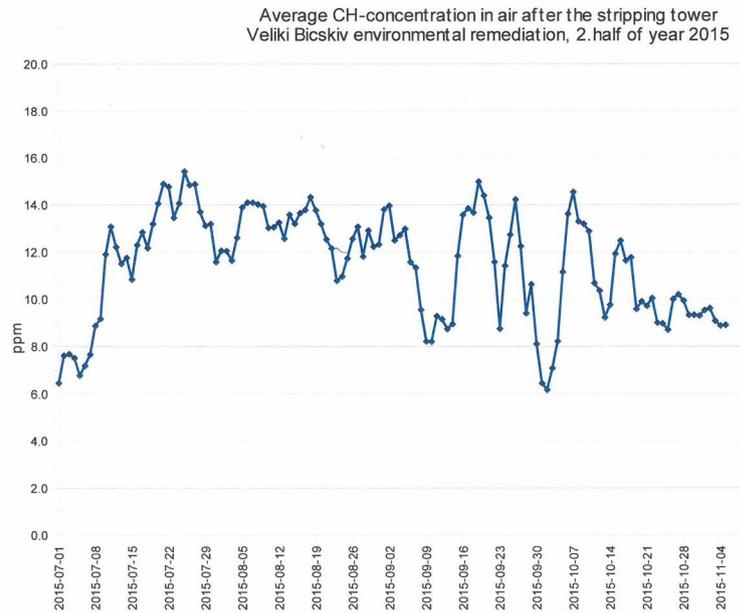
Water conductivity

Average: 2400 μ S/cm

Continuous operation, 2015

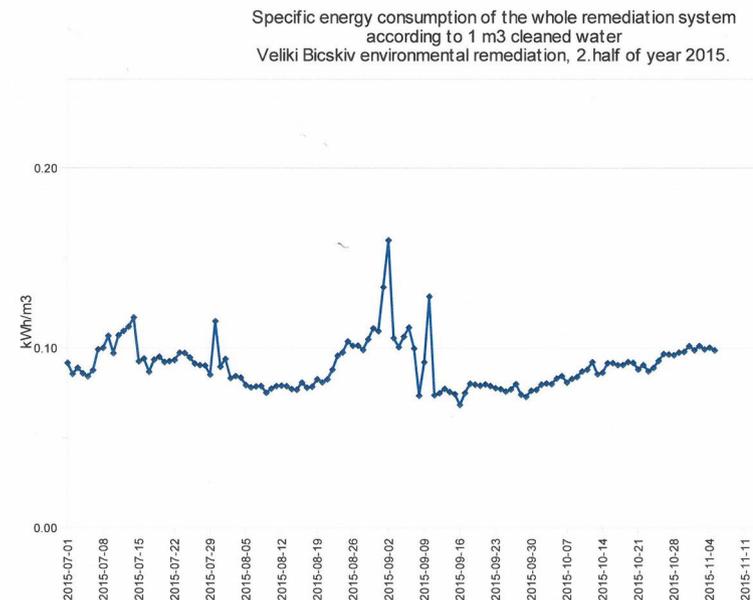
Непрерывная эксплуатация, 2015

Folyamatos üzemelés, 2015



CH-concentration in output air

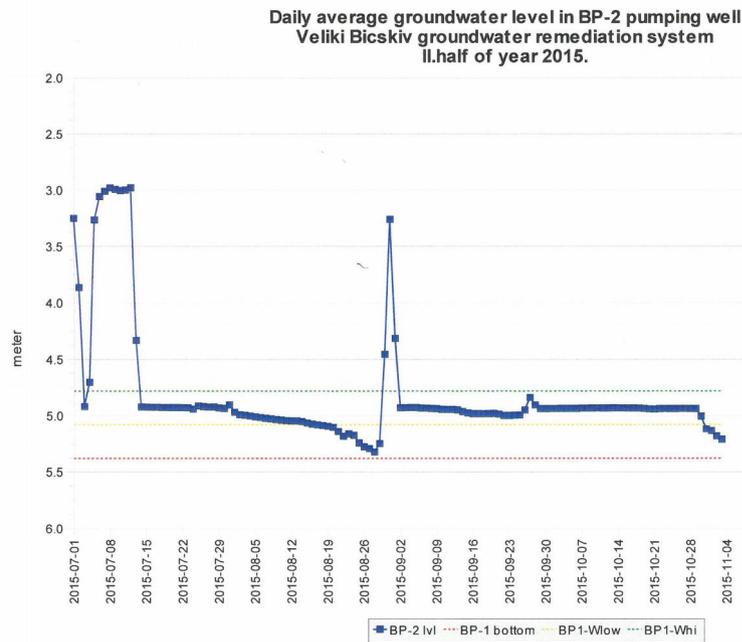
Summer: 12-14 ppm
Winter: 6-8 ppm



Energy consumption for 1 m³ water cleaning

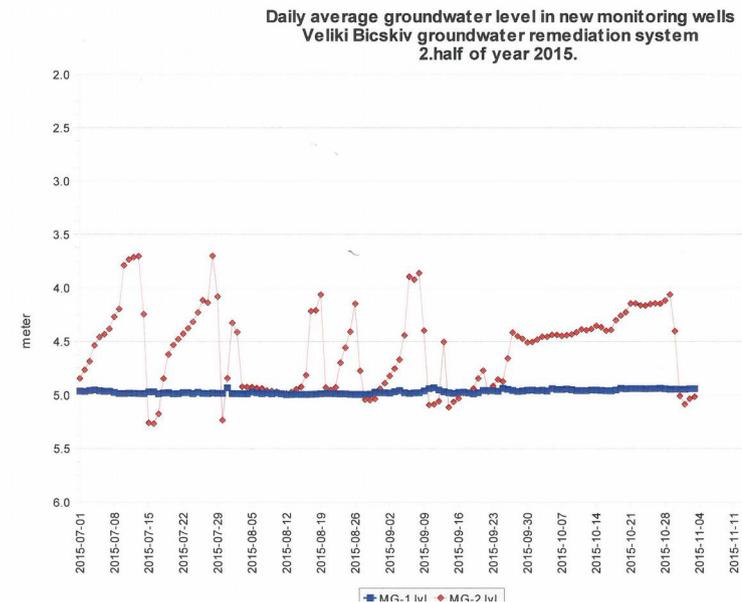
Average: 0,09 kWh/m³

Continuous operation, 2015 Непрерывная эксплуатация, 2015 Folyamatos üzemelés, 2015



GW level, BP-2 well

Level: 4,9 m



GW level, deep monitoring and production well

MG-1 level: 3,6 – 5,2 m

BP-8 level: 5,0 m

Difficulties in cleaning – additional work Трудности в очистке – дополнительные работы Nehézségek a tisztításban – pótmunkák



Main contamination source – the half underground mazout reservoir - still could not be fully demounted. This problem is partly solved, the solid wood resin is taken out, the concrete and walls are cleaned. Drain will be constructed in the middle.



Most difficult handy work is skimming the free phase floating material. Temporarily it was solved by a handy pump.
In November 2015 pneumatic mobile skimming system was started.



Difficulties in cleaning – additional work Трудности в очистке – дополнительные работы Nehézségek a tisztításban – pótmunkák



There are black manganese particles in cleaned water. We tried an experimental post-cleaner with zeolite filter that was only partly successful. A bigger post-filtering reservoir is needed.



There were several „surprises” during the work. Trying to built an infiltration well, a former drain was found f oil! The drain will be washed through by a pair of infiltration wells.



Difficulties in cleaning – additional work Трудности в очистке – дополнительные работы Nehézségek a tisztításban – pótmunkák



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Additional work Дополнительные работы Рótmunkák



Mobile pneumatic skimming system for floating phase



Drilling of 15 deep production well



Additional work Дополнительные работы Рótmunkák



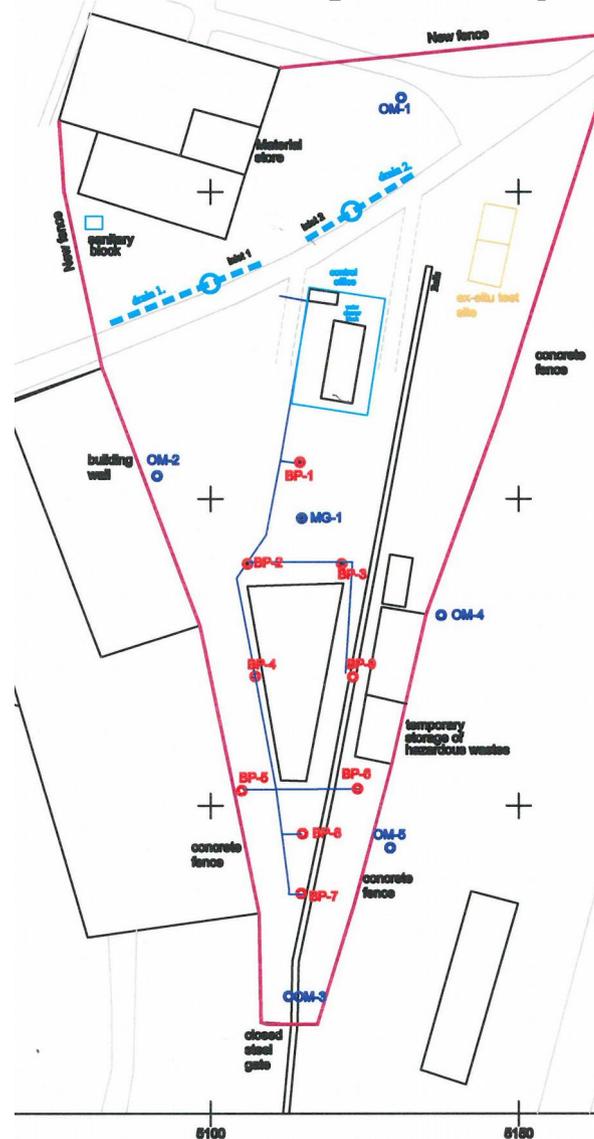
Building and exploiting of the experimental post-cleaner with zeolite filter



Infiltration well in concrete reservoir



Result map Карта - результат Eredmény térkép





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Thank you for your attention!
Спасибо за внимание!
Köszönöm a figyelmet!

Velikiy Bychkiv, 8th December 2015.

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Evaluation of results
Оценка результатов
Eredmények értékelése
BI-CENTRUM LTD.



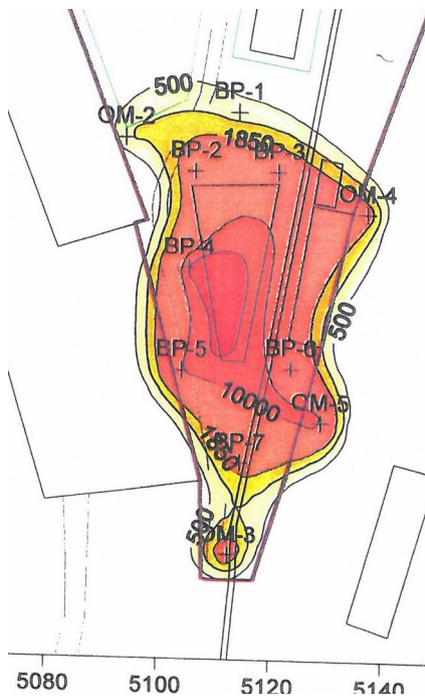
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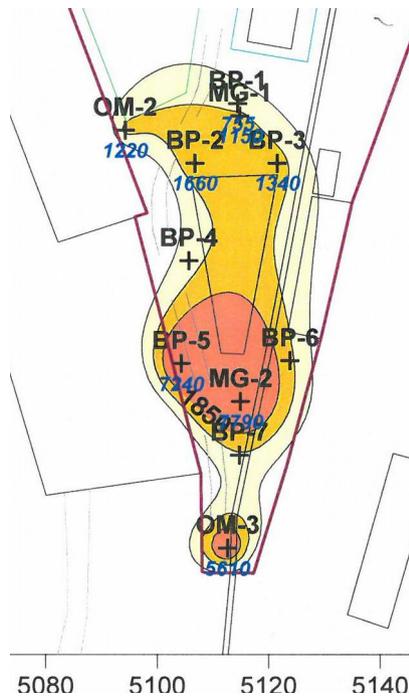


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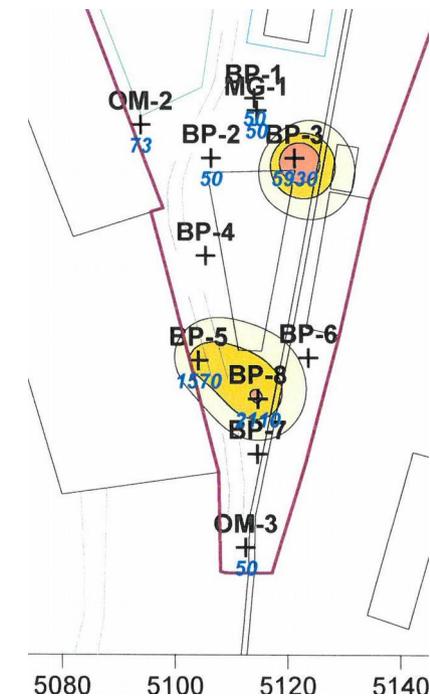
Changes during the 1 year cleaning Изменения за 1 год очистки Változások az 1 év kármentesítés alatt



November 2014



August 2015



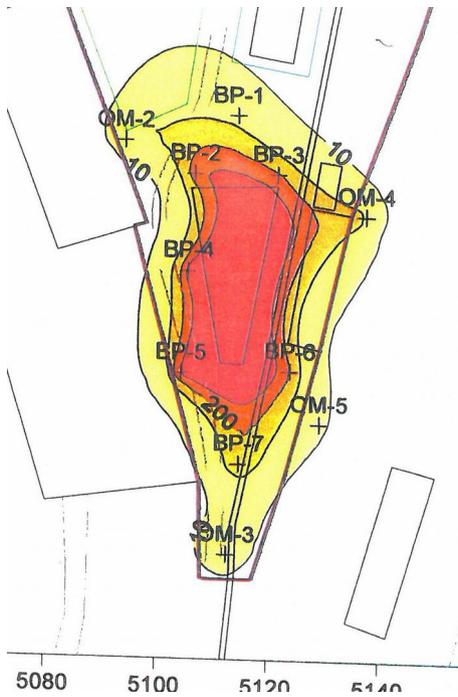
November 2015

TPH – Total Petroleum Hydrocarbon

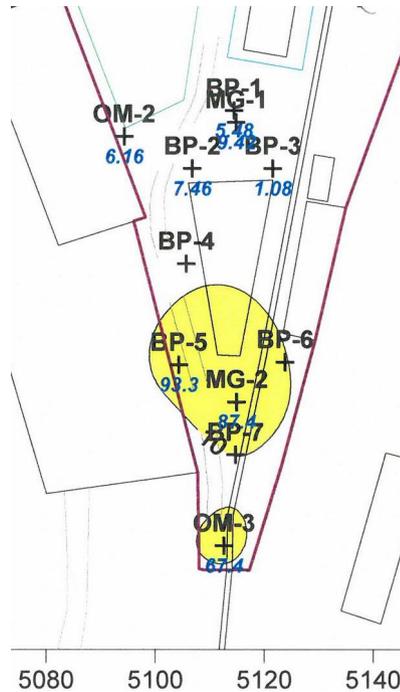
Changes during the 1 year cleaning

Изменения за 1 год очистки

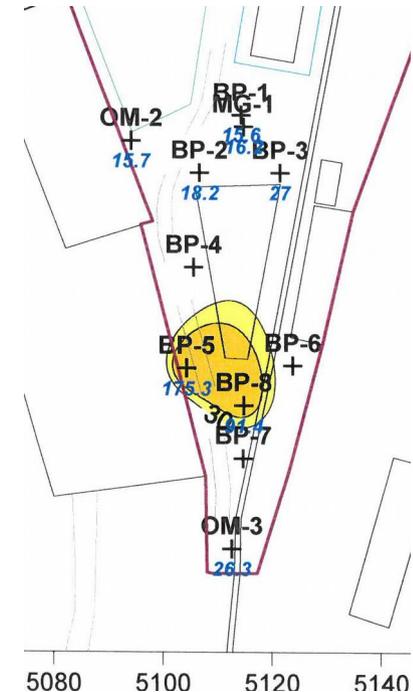
Változások az 1 év kármentesítés alatt



November 2014



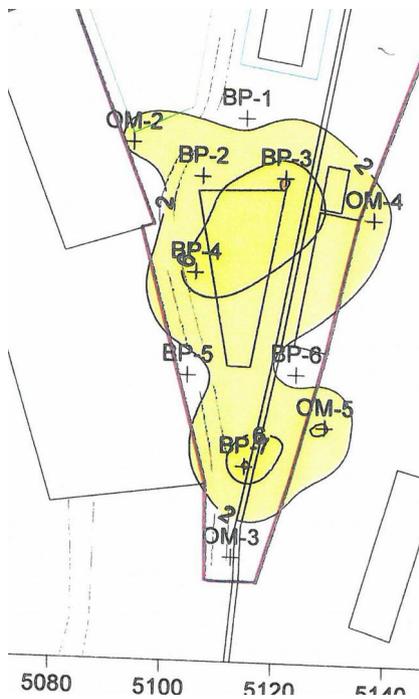
August 2015



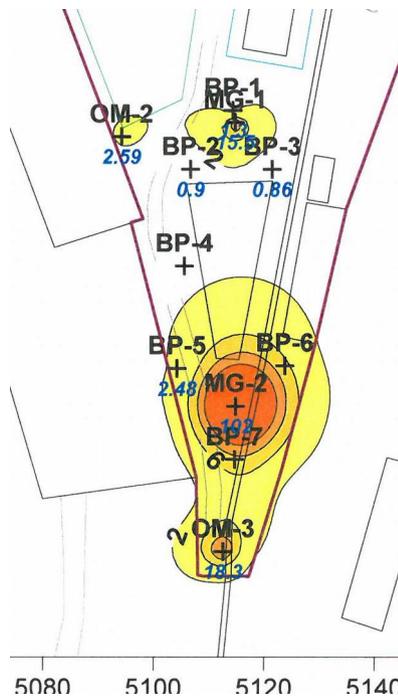
November 2015

BTEX – Benzene, Toluene, Ethylbenzene, Xilene

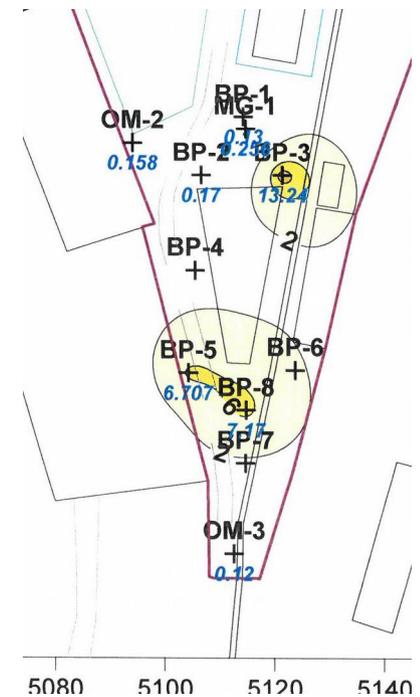
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November 2014



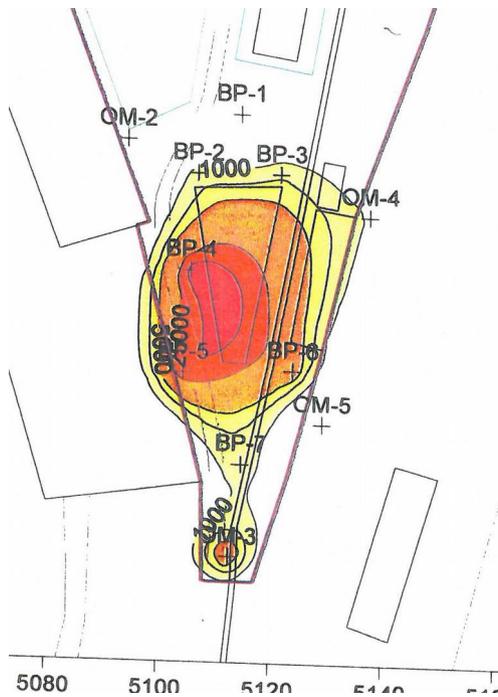
August 2015



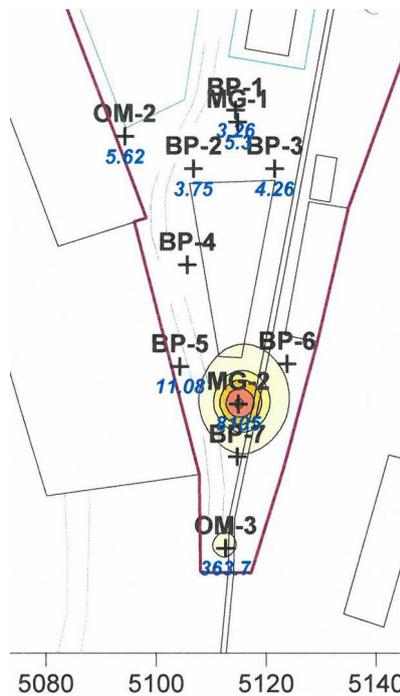
November 2015

PAH – Polyaromatics

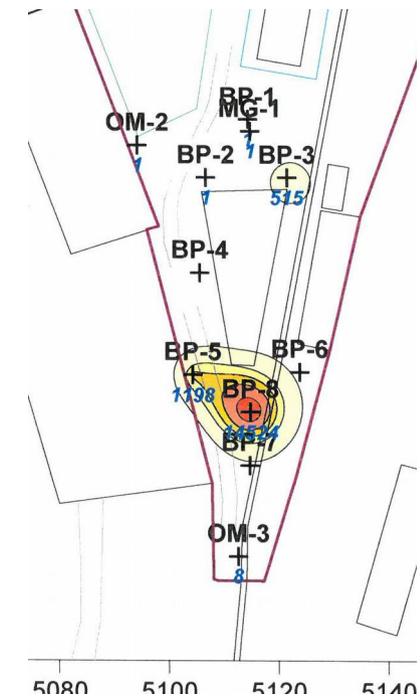
Changes during the 1 year cleaning Изменения за 1 год очистки Változások az 1 év kármentesítés alatt



November 2014



August 2015



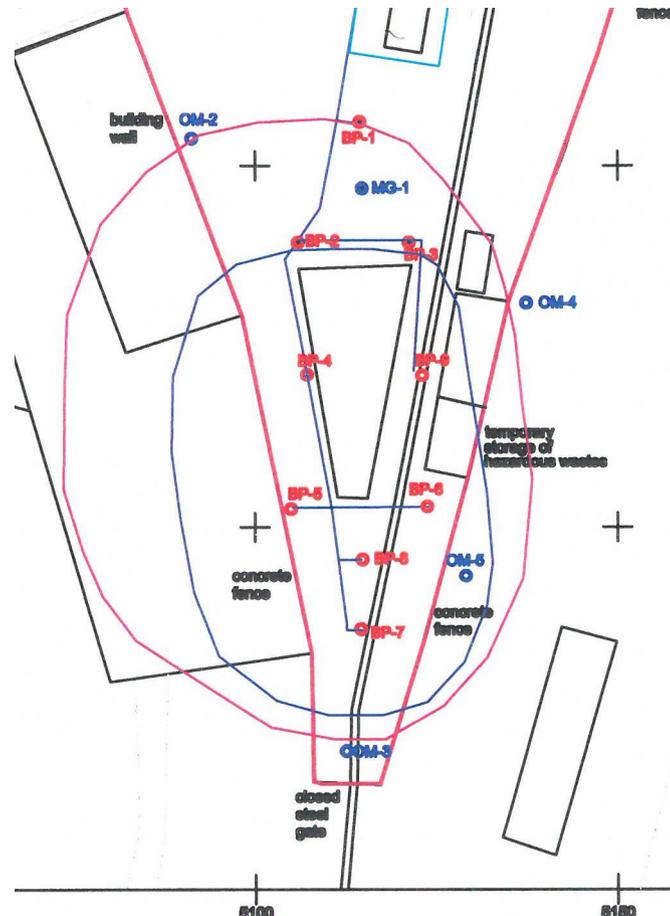
November 2015

Phenols and derivatives

Changes during the 1 year cleaning Изменения за 1 год очистки Változások az 1 év kármentesítés alatt

Red line: 11/2014

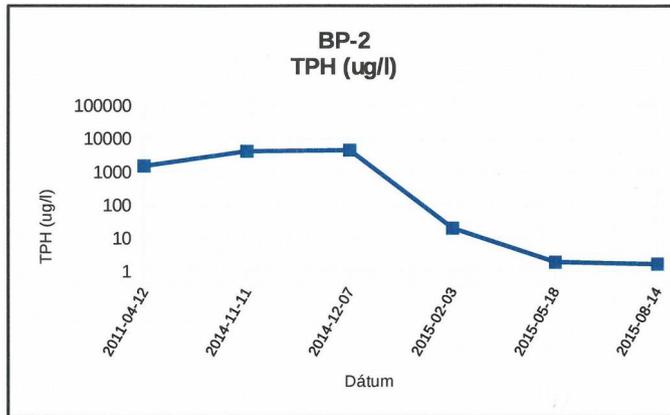
Blue line: 11/2015



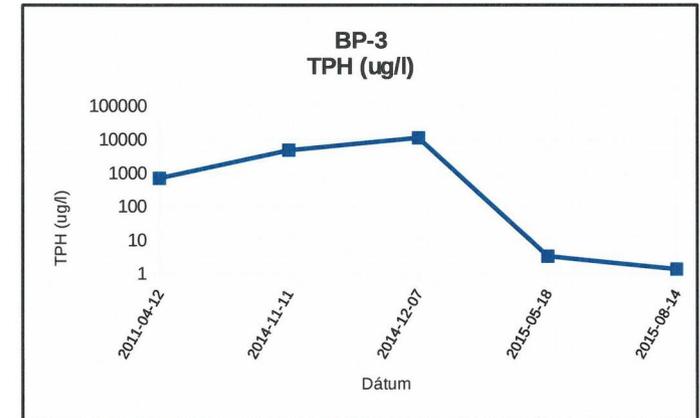
Change in free phase contour



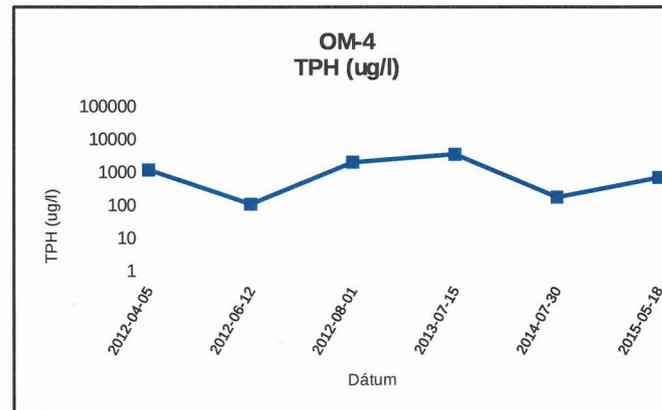
Changes in concentrations, water Изменения концентраций, вода Koncentráció változások, víz



Decrease from 5000 to 5



Decrease from 10000 to 1

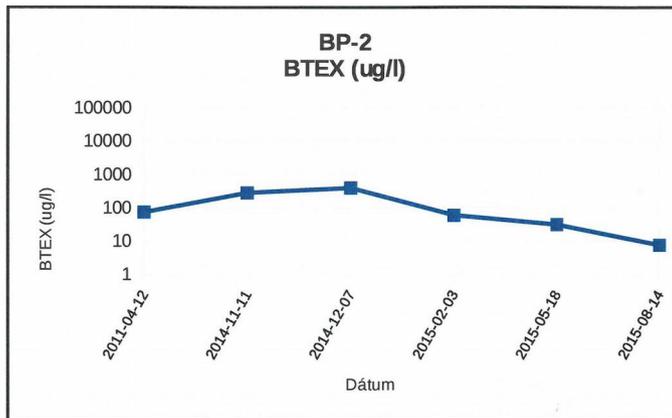


Decrease from 2000 to 800

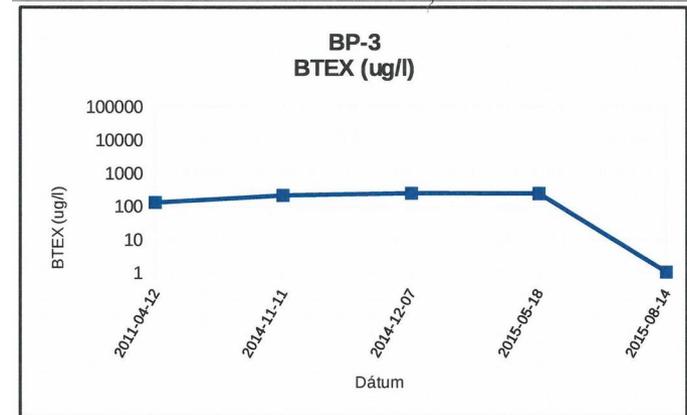
TPH – Total Petroleum Hydrocarbon, wells BP-2, BP-3, OM-4



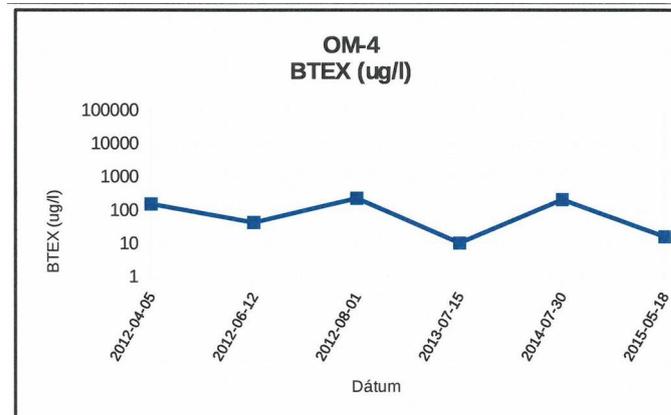
Changes in concentrations, water Изменения концентраций, вода Koncentráció változások, víz



Decrease from 500 to 8



Decrease from 300 to 1



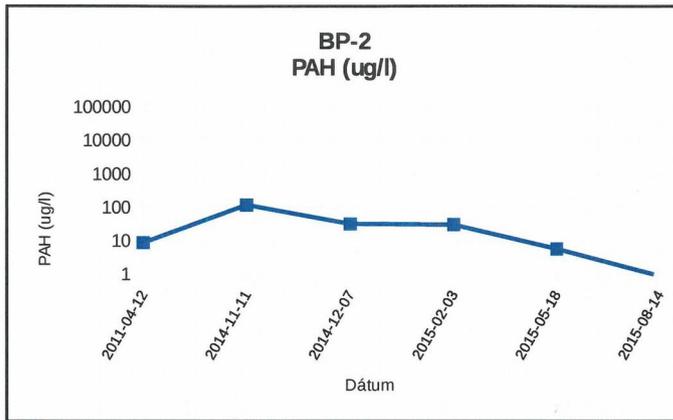
Decrease from 200 to 10

BTEX, wells BP-2, BP-3, OM-4

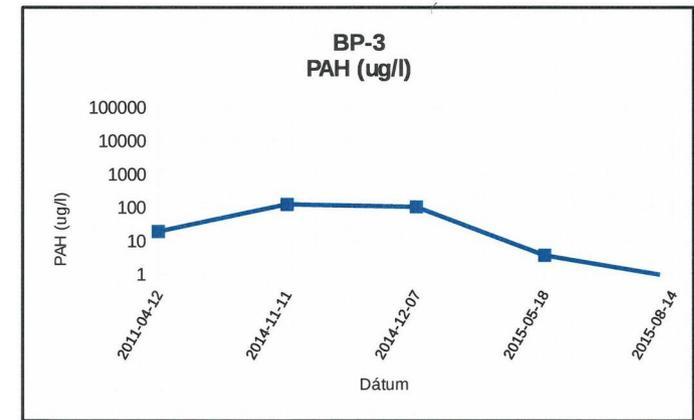
Changes in concentrations, water

Изменения концентраций, вода

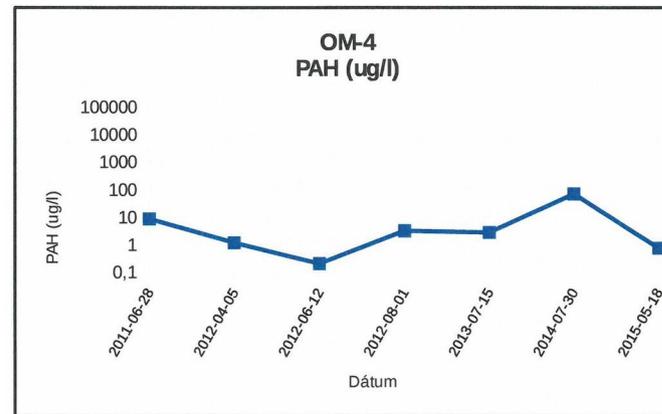
Koncentráció változások, víz



Decrease from 100 to 1



Decrease from 100 to 1

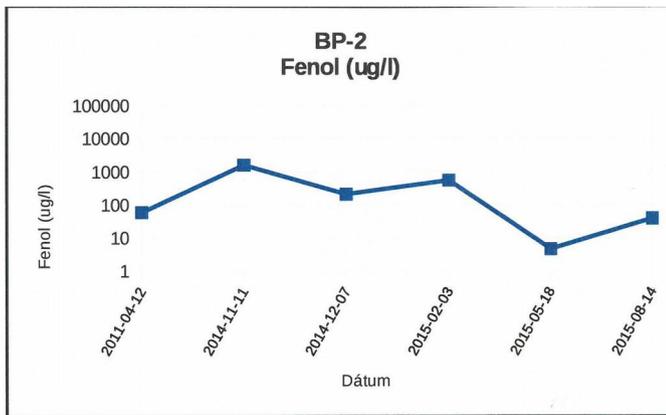


Decrease from 80 to 1

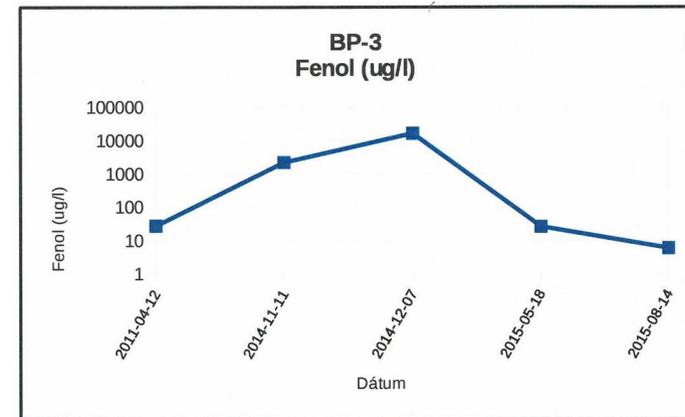
PAH, wells BP-2, BP-3, OM-4



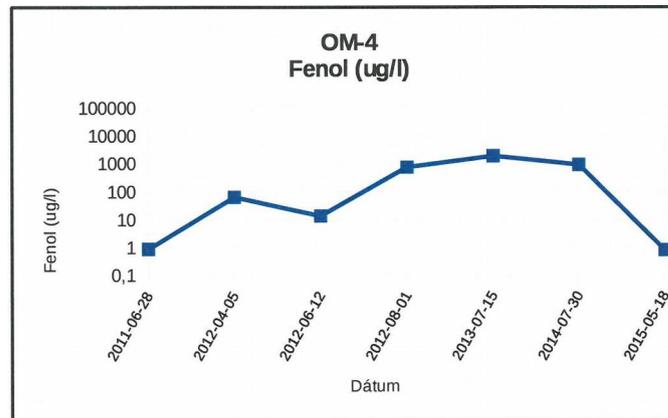
Changes in concentrations, water Изменения концентраций, вода Koncentráció változások, víz



Decrease from 1000 to 40



Decrease from 10000 to 10



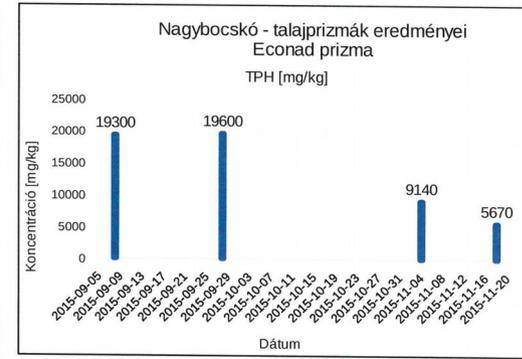
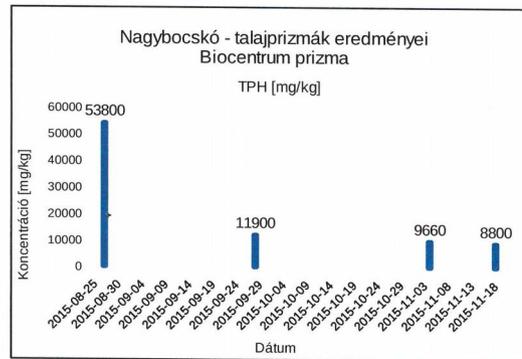
Decrease from 1000 to 1

Phenols, wells BP-2, BP-3, OM-4

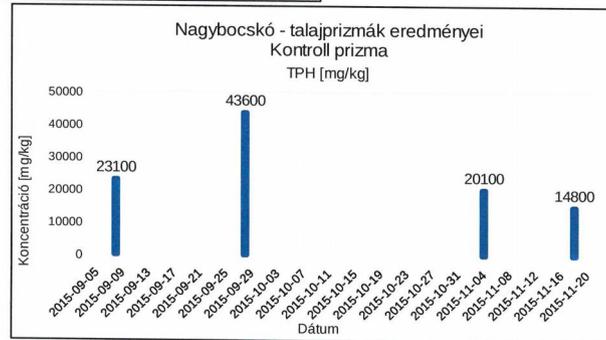
Changes in concentrations, ground prisms

Изменения концентраций, грунтовые призмы

Koncentráció változások, talaj prizmák



Enzymatic prism
Decrease from 53800 to 8800



Biopreparate prism
Decrease from 19300 to 5760

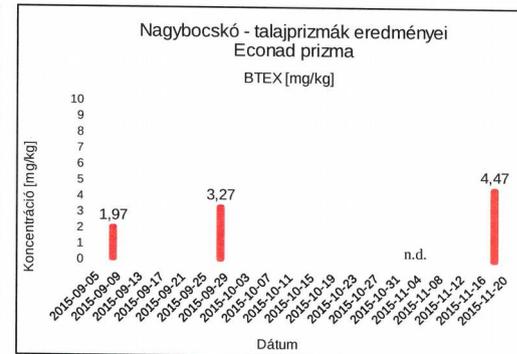
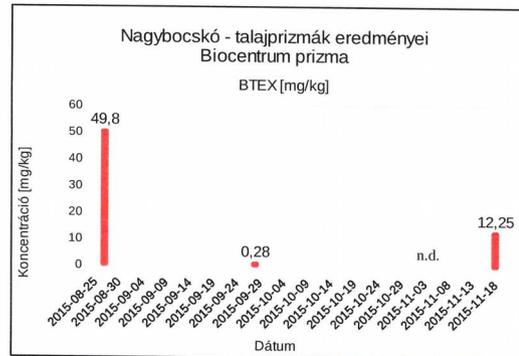
Control prism
Decrease from 23100 to 14800

TPH

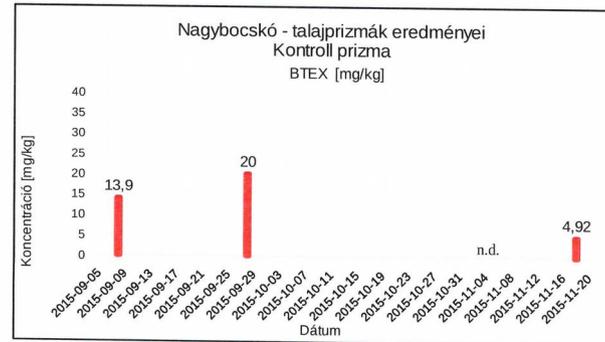
Changes in concentrations, ground prisms

Изменения концентраций, грунтовые призмы

Koncentráció változások, talaj prizmák



Enzymatic prism
Decrease from 49,8 to 12,2

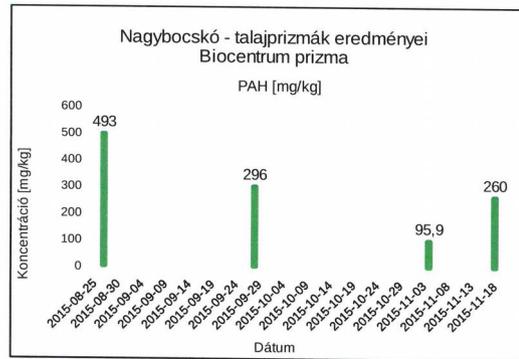


Biopreparate prism
Decrease from 3,3 to n.d. (?)

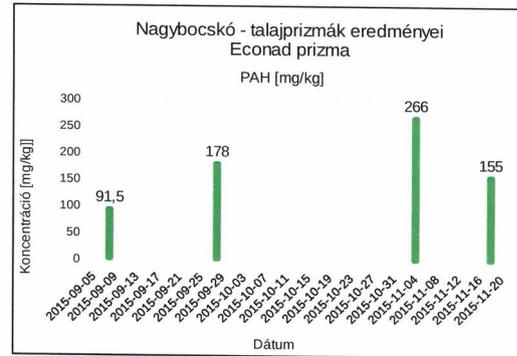
Control prism
Decrease from 13,9 to 4,9

BTEX

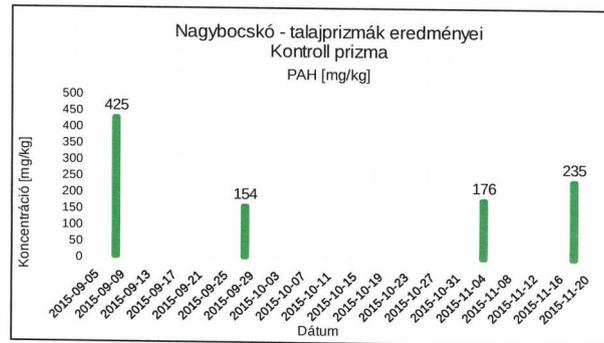
Changes in concentrations, ground prisms Изменения концентраций, грунтовые призмы Koncentráció változások, talaj prizmák



Enzymatic prism
 Decrease from 493 to 260



Biopreparate prism
 Decrease (?)

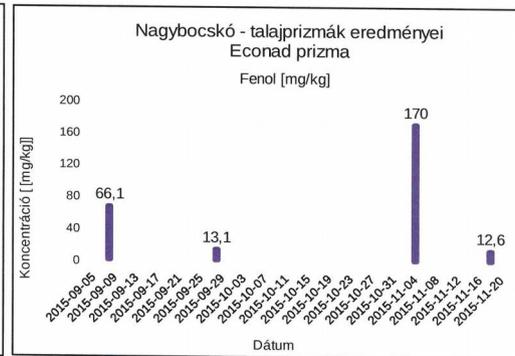
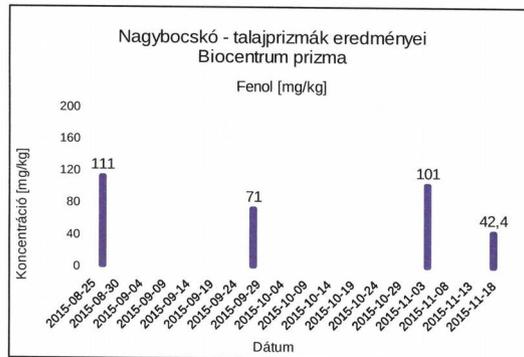


Control prism
 Decrease from 425 to 235 (?)

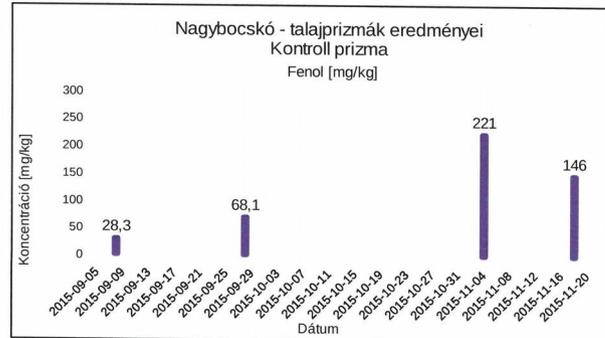
PAH



Changes in concentrations, ground prisms Изменения концентраций, грунтовые призмы Koncentráció változások, talaj prizmák



Enzymatic prism
Decrease from 111 to 42,4

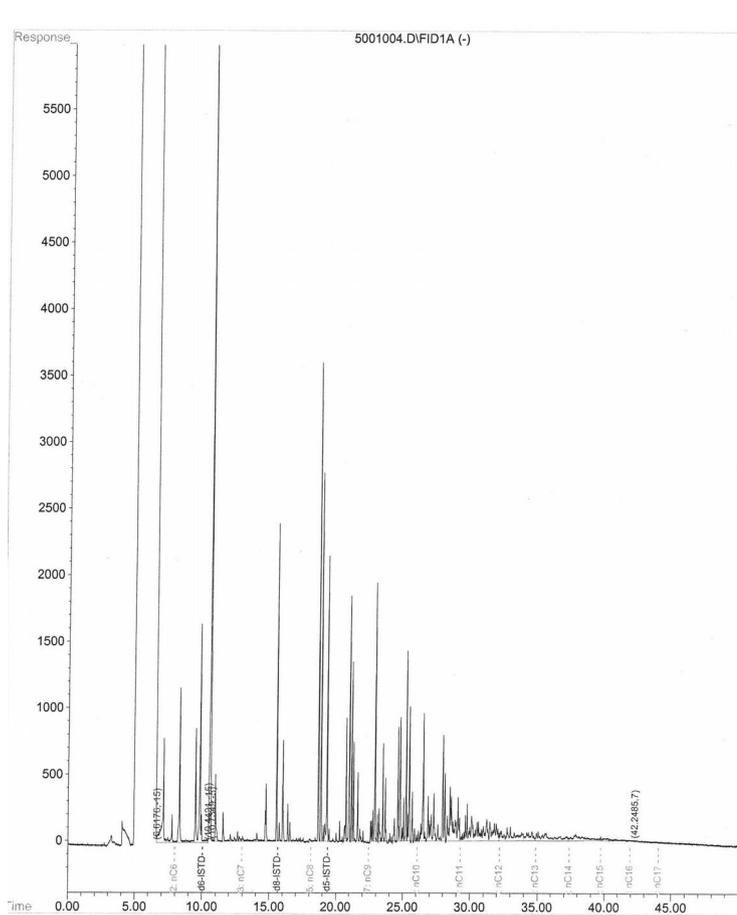


Biopreparate prism
Decrease from 66 to 12,6

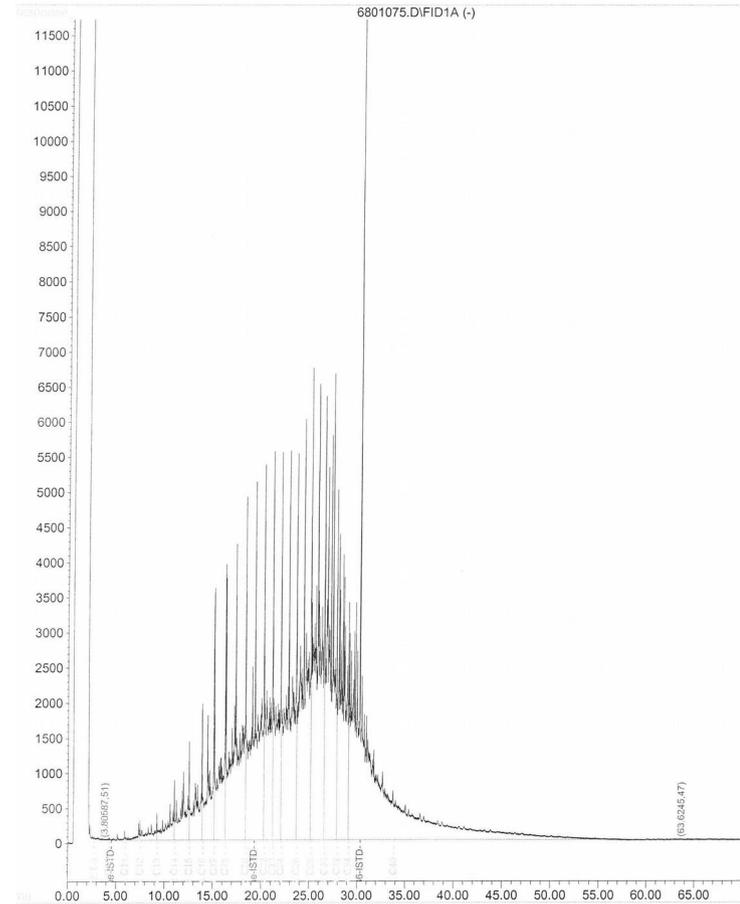
Control prism
Decrease (?)

Phenol

Resin chromatograms Кроматограммы смолы Gyanta kromatogramok



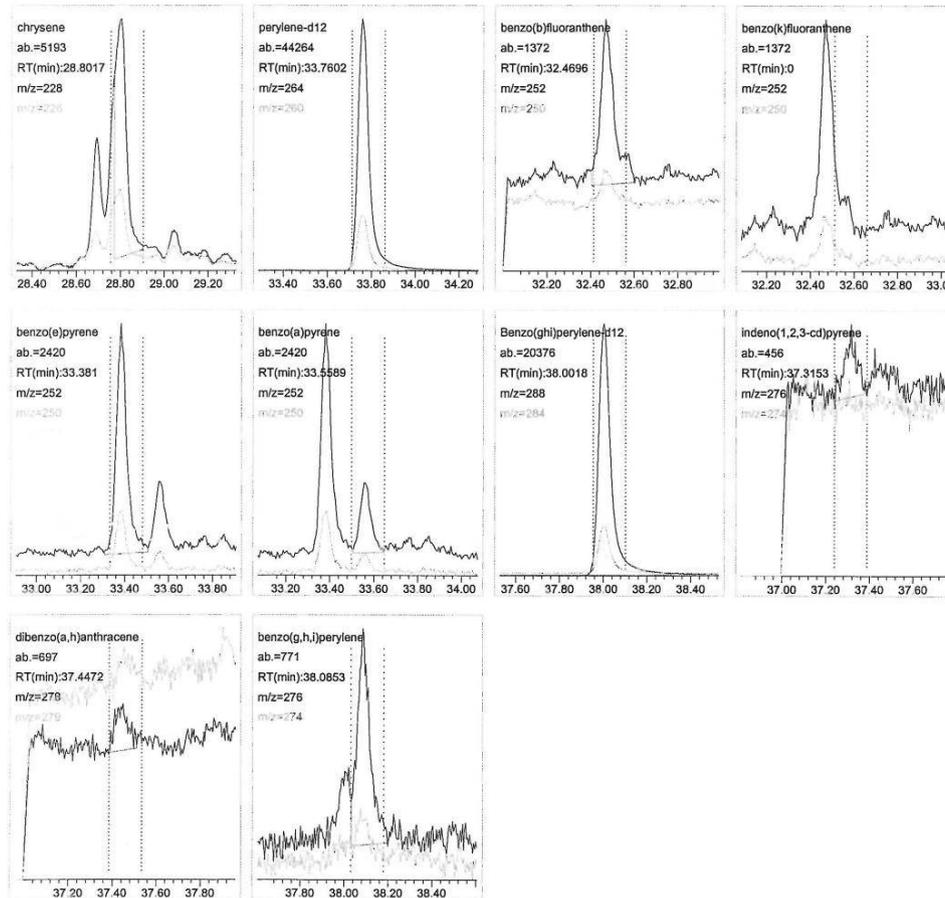
Volatile parts



Non volatile parts



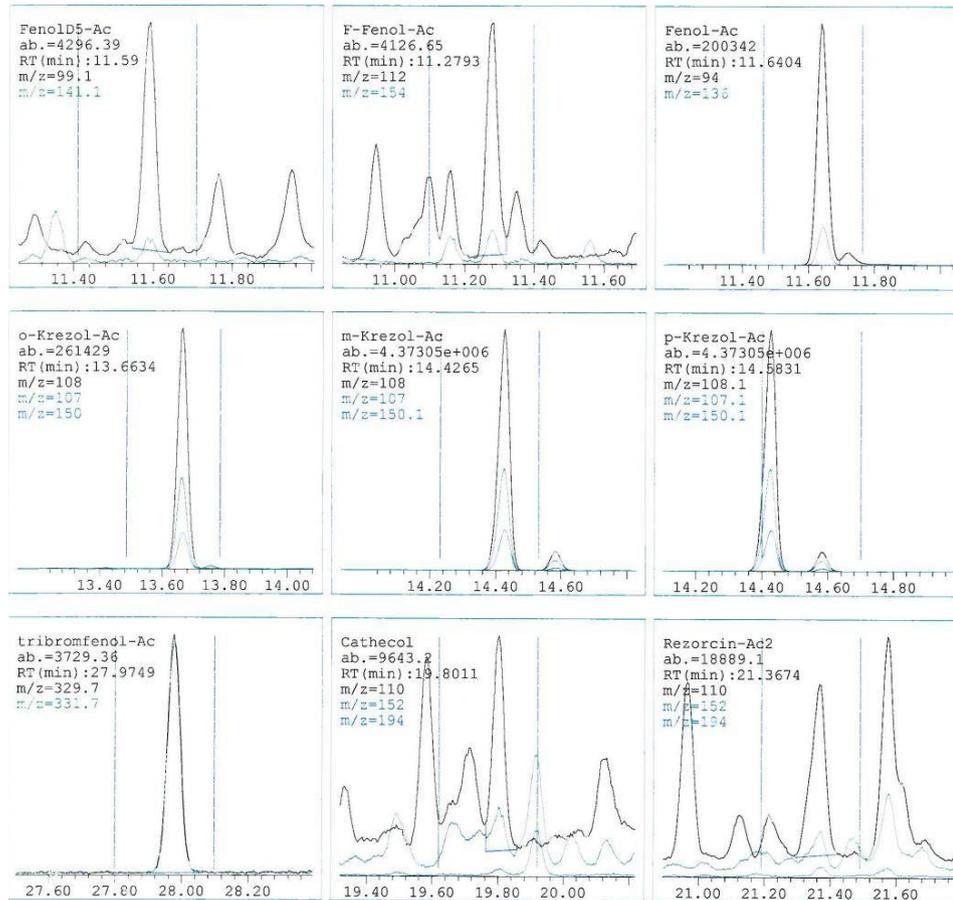
Resin chromatograms Кроматограммы смолы Gyanta kromatogramok



Heavy PAHs



Resin chromatograms Кроматограммы смолы Gyanta kromatogramok



Phenol and derivatives



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Future plans
Планы на будущее
A jövő terveit

BI  CENTRUM LTD.

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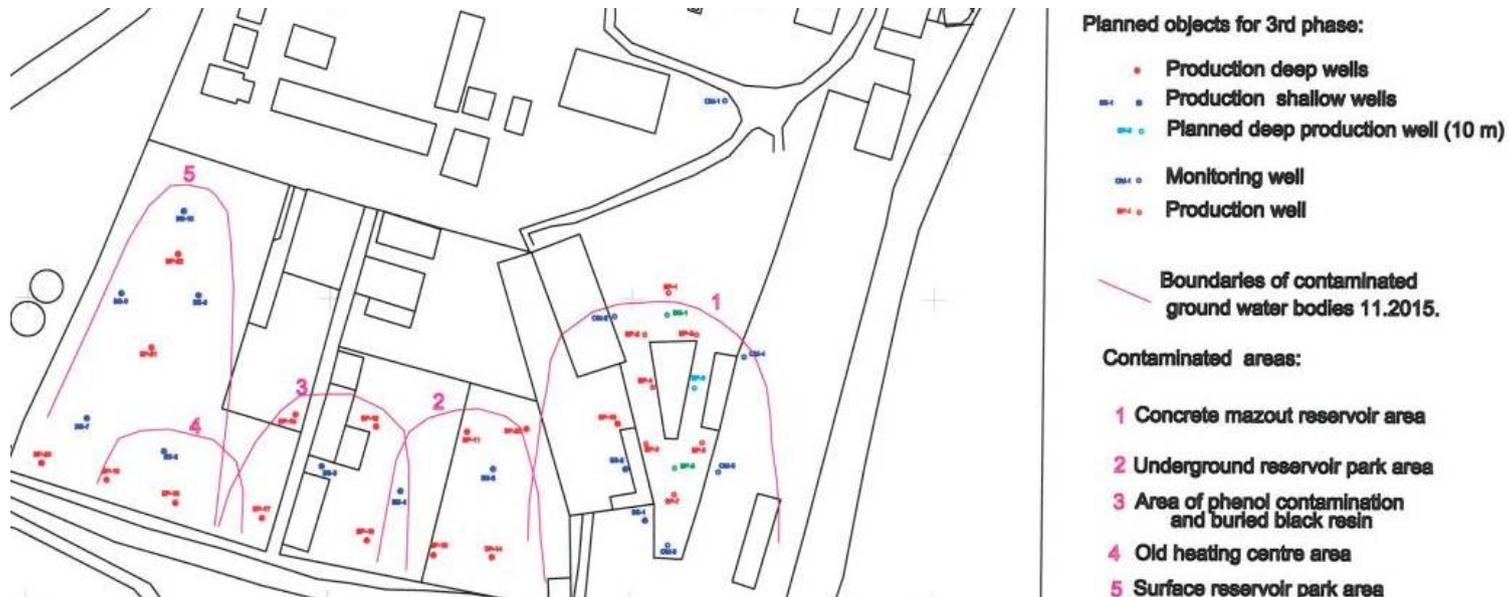
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Planned objects, phase 3.
Планируемые объекты, фаза 3.
Tervezett objektumok, 3. fázis



Full version, 5 contaminated areas

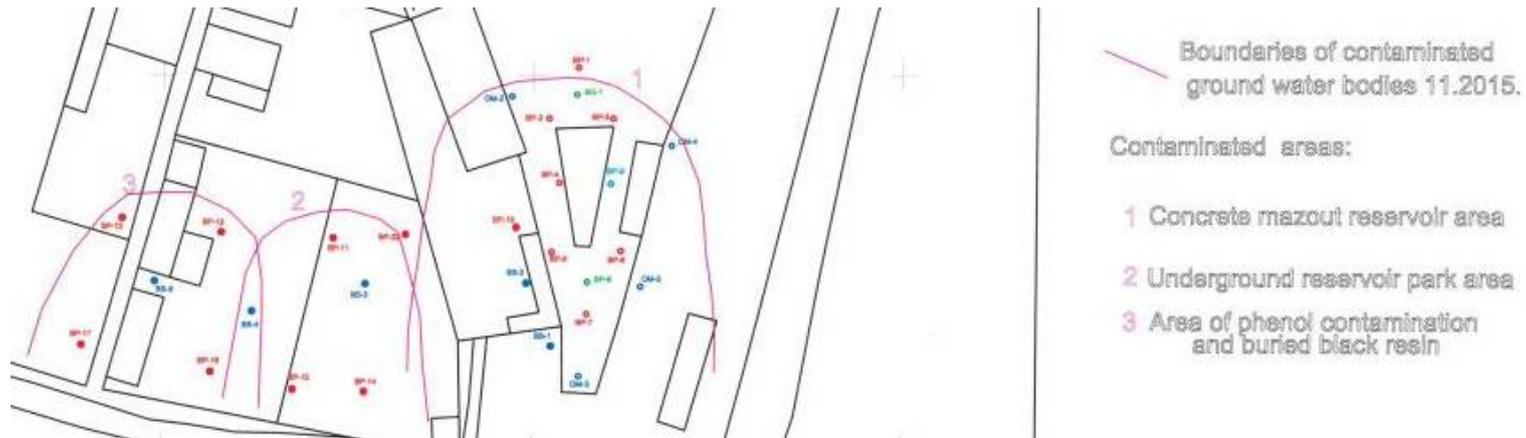
Planned objects, phase 3.
Планируемые объекты, фаза 3.
Tervezett objektumok, 3. fázis



Version 1, Hydraulic dam, 9 wells

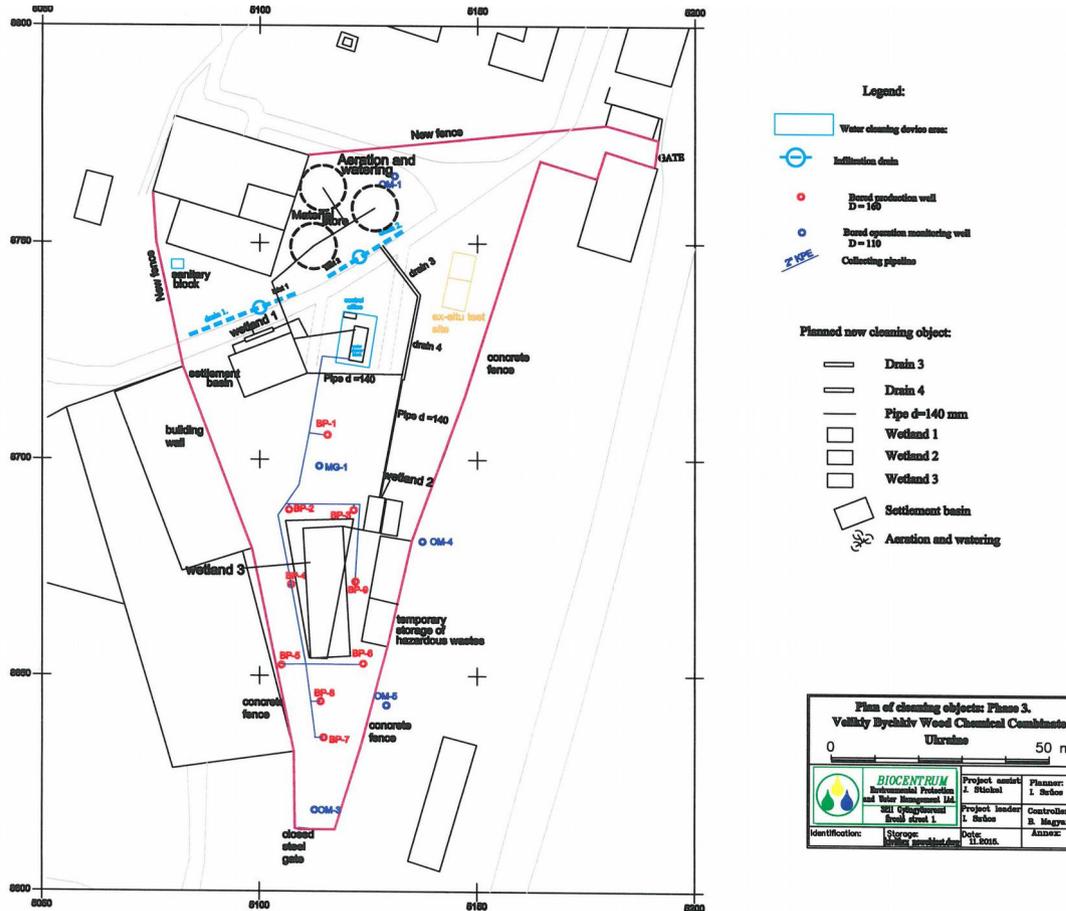


Planned objects, phase 3.
Планируемые объекты, фаза 3.
Tervezett objektumok, 3. fázis



Version 2, Additional areas 2 and 3

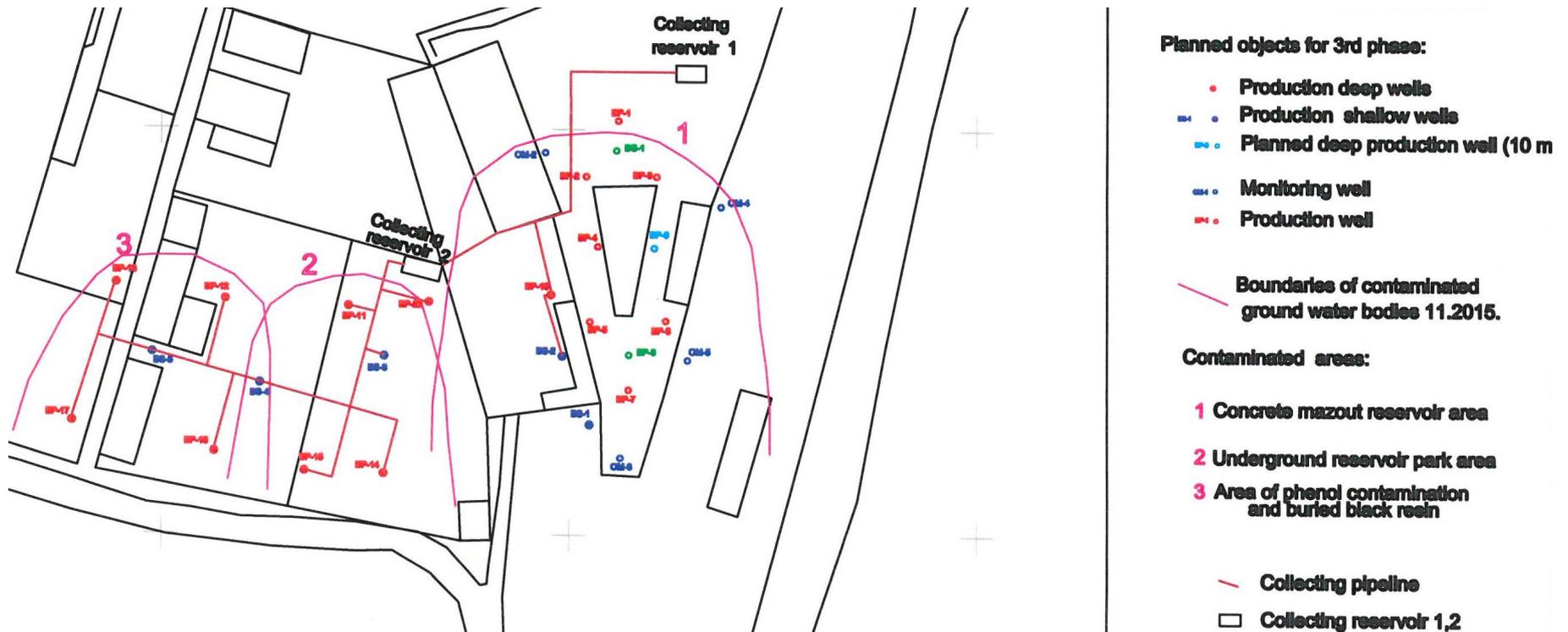
Planned objects, phase 3. Планируемые объекты, фаза 3. Tervezett objektumok, 3. fázis



Planned extension of existing water cleaning system on area 1



Planned objects, phase 3.
Планируемые объекты, фаза 3.
Tervezett objektumok, 3. fázis



Planned extension of water cleaning system (wells and pipelines) on area 2 and 3.



Hungary-Slovakia-Romania-Ukraine
ENPI Cross-border Cooperation Programme

“2nd Phase of the project: „Starting Remediation”

Project number: HUSKROUA/1101/057

Thank you for your attention!
Спасибо за внимание!
Köszönöm a figyelmet!

Velikiy Bychkiv, 8th December 2015.

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