Subsidence wetland formation and transition in the coal mining areas with high ground water table

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Underground coal mining in China

Coal production in China

From BP World Energy Review 2016

Underground coal mining

About 90% of coal in China produced by underground coal mining.
Subsidence: over 1 million hectare of subsided land; 70 thousands ha of land is subsided every year (estimated in 2011)
Subsidence land Reclamation has become an urgent task in China
Coal mining areas with high ground water table

In China, including 5 of the 14 main coal basins, high ground water table, thick coal seams, multiple coal seams, and flat terrain are common. Most of these areas are "overlap areas".

What’s next for reclamation? ASMR Joint Conference
April 9-13, 2017, Morgantown, WV
Coal mining areas with high ground water table

Farmland Eco-system

Underground coal mining

What’s next for reclamation? ASMR Joint Conference
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Reclaiming subsided land for farmland

Digging deep to fill shallow with hydraulic dredge pump

Filling reclamation with coal wastes, fly ash and river sediments

Reclaimed Farmland by non-filling reclamation Technology

Reclaimed land by filling reclamation technology
Reclaiming subsided land for “wetland”

Land Reclamation: restoring disturbed land to a useful state ---- water

Utilization of the water in subsided land is very important!
Coal mining areas with high ground water table

Water logging areas

For better utilizing the water of subsidence land and best practice reclamation of subsided land for wetland

Some basic information needed

- Are they wetland?
- What’s the characteristics and changes with time and spatio?
- How to classify the subsidence wetland?
- Transition of the subsidence wetland?
“Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.”

1971 Convention on Wetlands of International Importance especially as Waterfowl Habitat

They should be included in the wetland system!
Formation of subsidence wetland

Formation of subsidence basin

Waterlogging in the subsidence basin

- Curving Zone
- Fissure Zone
- Caving Zone
- Coal seams
- Goaf

Surface water recharge

Ground water table

Rainfall

Leakage

Lateral recharge from shallow ground water

Seasonal water

Perennial water

Ground water recharge

Subsidence boundary (10mm)

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Formation of subsidence wetland

Formation of subsidence wetland soil and vegetation – mining and subsidence process

Hydromorphic soil

aquatic vegetation

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Classification of subsidence wetland

The subsidence wetland could be classified according to the restoration process.

Subsidence wetland

Construction wetland

Natural succession

Restoration mainly depend on the natural succession process

Restoration process highly influenced by human interference
Classification of subsidence wetland

Natural succession

Subsidence lake

Subsidence fen

What’s next for reclamation? ASMR Joint Conference
April 9-13, 2017, Morgantown, WV
Tangshan South Lake Park 唐山南湖公园
Industrial Square Restoration

Shaft Restoration

Wetland Restoration

Wetland Restoration
Classification of subsidence wetland

Construction wetland

Aquaculture

Recreation/waste water treatment

Water reservoir

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Transition of Subsidence wetland

Legend

- YanZhou coal
- Highway
- Railway
- Rivers
- Lakes

What’s next for reclamation? ASMR Joint Conference
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Land use and wetland types in 1995, 2005, 2010 and 2015

What’s next for reclamation? ASMR Joint Conference
April 9-13, 2017, Morgantown, WV
### Land use and wetland types in 1995, 2005, 2010 and 2015

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<th>Type</th>
<th>1995</th>
<th>2005</th>
<th>2010</th>
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<td>9476.6</td>
<td>12042.67</td>
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Conclusion

• The subsided land logging water is the wetland, which has huge areas in the coal mining areas with high ground water. The subsidence wetland increase consistently in these areas, and this trend will continue in the near future.

• It can be classified as natural process and construction wetland.

• The ecological situation of subsidence wetland should be focused. The wetland transition among different types and with other land use is complicated, therefore, its ecological situation vary considerably.

• More restoration and management measures should be taken to enhance the ecological function of the subsidence wetland. Most of the subsidence wetland is under natural succession with spontaneous human interrupt and without restoration and management.
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The 2nd International Symposium on Land Reclamation and Ecological Restoration
October 20-23, 2017, Holiday Inn Xi'an Big Wild Goose Pagoda
Theme: Land Reclamation in Ecological Fragile Areas

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China University of Mining and Technology (Beijing)

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Committee of Land Reclamation and Ecological Restoration, China Coal Society
Xi’an University of Science and Technology
Chinese Ecological Restoration Network (www.ER-CHINA.com)

Co-Organizers
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Welcome to XI’AN to attend our conference

The symposium on land reclamation and ecological rehabilitation is a series of international conference, held every three years. The first symposium was held successfully on 16th - 19th October, 2014 in Beijing, China. Nearly 60 foreign scholars from 15 countries and more than 300 domestic scholars to participate the symposium. The deep discussion and communication of mine restoration and land reclamation in China including legislation and practice, technology and theory and so on, promote the development of the mining area ecological environment and land reclamation.

16- 19 October, 2014, Beijing, China
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Major topics covered by the Conference, but not limited, are as follows:
Mining impact on environment
Monitoring, prediction and assessment of mining impact on land environment
Mining methods and measurements to minimize the land and environment impact
Mining and reclamation policies, regulations and standard
AMD treatment
Soil and landscape reconstruction
Revegetation and biodiversity protection
Subsidence land reclamation and ecological restoration
Surface mined land reclamation and ecological restoration
Solid wastes management, waste dump and tailings pond restoration
Case study
Abandoned mine land reclamation and ecological restoration
Contaminated land remediation
Reclaimed land monitoring and evaluation
Land reclamation supervision
Products and industrialization
Education, technology transfer and international cooperation of mine land reclamation
“The Belt and Road Initiative” and mine land Restoration

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The famous historic and cultural city

Emperor Qin's Terra Cotta Warriors

Interesting places and good food
Thank you!

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