Influence of Subway Construction on Groundwater Environment in Downtown Area of Chengdu , Sichuan, China

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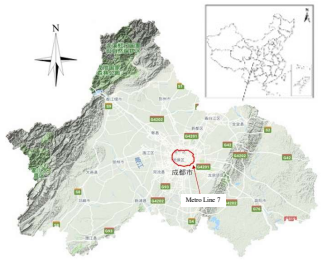
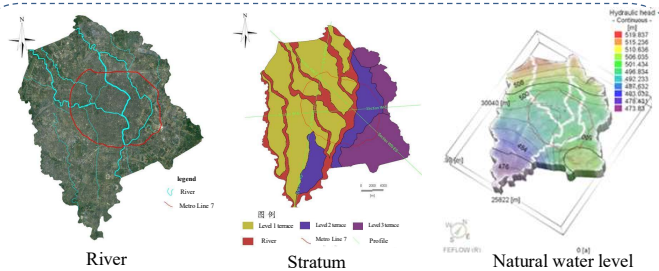
1. Introduction

Fig1 The scenes of Chengdu

Located at the southeast of the Minjiang alluvial-proluvial fan, the downtown area of Chengdu mainly composed of sand gravel layer. Now Chengdu has 8 subway lines operated; in the next 10 years, more than 34 routes will be constructed. Metro Line 7 forming a transfer relationship with multiple urban MRTS and urban commuter radiation built completly in downtown area, with depth of subway station 1.73-11.3 m, and the depth of interval tunnel 6.47-28.01 m. In order to study how the groundwater will be influenced, 3 3d groundwater numerical models in different scales have been constructed using FeFlow software, the results illustrated regional groundwater seepage field and local seepage field.



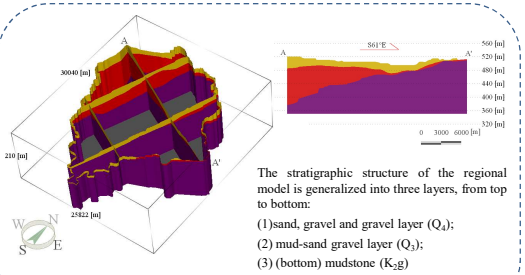


River Stratum Natural water level

Fig3 Basic conditions of metro circle line 7 in Chengdu downtown

Baed on 1 regional model (417 km^2 for downtown Chengdu) and 2 models of typical underground space (Taipingyuan station and Yipintianxia station), at the same time with the basic geology and hydrogeology Analysis, shows that:

(1) The influence of metro line 7 on the seepage field is relatively limited in regional scale, and the change of groundwater level is very little(4-10cm) at several typical observation points; in the long-term, the raising of groundwater level will decrease gradually.



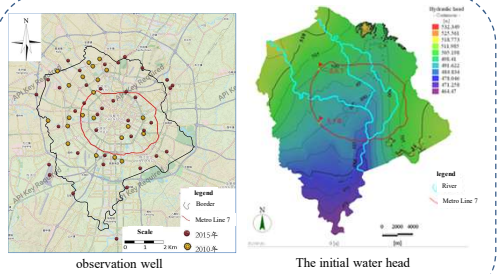
The stratigraphic structure of the regional model is generalized into three layers, from top to bottom:

(1)sand, gravel and gravel layer (Q_4);

(2) mud-sand gravel layer (Q_3);

(3) (bottom) mudstone (K_2g)

Fig4 Stratigraphic texture of Chengdu downtown



observation well The initial water head

Fig5 Initial groundwater head of Chengdu downtown

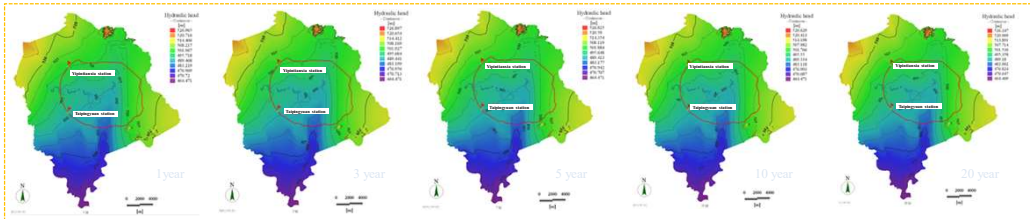
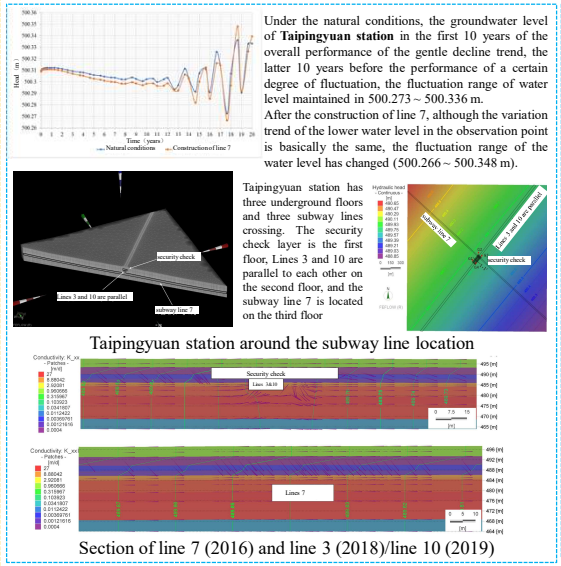


Fig6 Evolution of seepage field in subway 7# construction

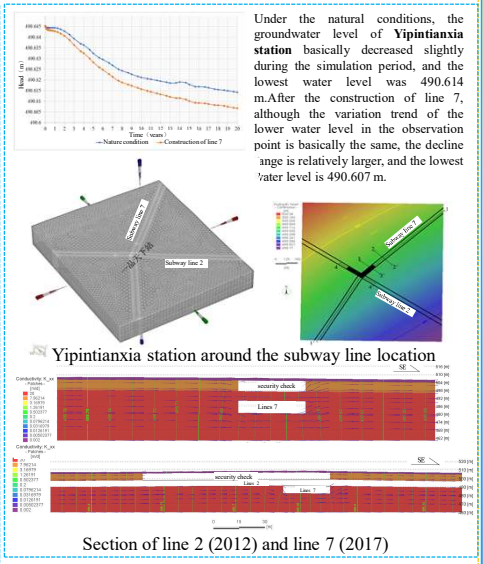


Under the natural conditions, the groundwater level of **Taipingyuan station** in the first 10 years of the overall performance of the gentle decline trend, the latter 10 years before the performance of a certain degree of fluctuation, the fluctuation range of water level maintained in 500.273～500.336 m.

After the construction of line 7, although the variation trend of the lower water level in the observation point is basically the same, the fluctuation range of the water level has changed (500.266～500.348 m).

Taipingyuan station has three underground floors and three subway lines crossing. The security check layer is the first floor, Lines 3 and 10 are parallel to each other on the second floor, and the subway line 7 is located on the third floor

Taipingyuan station around the subway line location



Under the natural conditions, the groundwater level of **Yipintianxia station** basically decreased slightly during the simulation period, and the lowest water level was 490.614 m.After the construction of line 7, although the variation trend of the lower water level in the observation point is basically the same, the decline range is relatively larger, and the lowest water level is 490.607 m.

Yipintianxia station around the subway line location

Section of line 7 (2016) and line 3 (2018)/line 10 (2019) Section of line 2 (2012) and line 7 (2017)

Fig7 The Comparison of typical subway stations: cross-traffic structure

(2) Comparing the simulation results of Taipingyuan station and Yipintianxia station shows the impact of subway construction on the groundwater environment in the downtown Chengdu. In the big view, from northwest to southeast, the phenomenon of underground water interception or raising in subway stations decrease gradually, this is owing to the influence of aquifer thickness, groundwater flow direction and the direction of underground station structure.

(3) As the main body or long section of the underground structure is coincide with the groundwater flow direction, the cross-section blocking the groundwater is minimized, so its influence on the groundwater seepage field is not notable even with development of the underground space, this is also help avoiding the floatation effect on the building foundation due to the raising of the groundwater flow.

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