Groundwater-level altitudes and changes in the Chicot, Evangeline, and Jasper Aquifers (2020) and compaction in the Chicot and Evangeline Aquifers (1973-2019) for the Houston-Galveston Region, Texas

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Overview

- Approach and Methods
- Gulf Coast Aquifer System
- Groundwater Monitoring Network
- Groundwater-Level Maps by Aquifer
  - Current water-level altitudes
  - 1-year and 5-year water-level change
  - Long term water-level altitude change
- Cumulative Compaction
**Approach and Methods**

- **Measure static water-levels**
  - 673 public supply, irrigation, industrial, and observation wells in 11-county Houston-Galveston region
  - Measured between December and March with USGS approved methods

- **Data interpretation**
  - Data and analysis:
    - 1. Quality assured
    - 2. Peer reviewed by USGS prior to annual hearing and public comment period

- **Final Publication**
  - Data, interpretations, depictions, and documents are archived, published, and made available to the public

**Groundwater Network**

- Strong collaboration with local well owners, municipalities, MUDs, PUDs, SUDs
- Chicot and Evangeline aquifers are hydraulically connected: withdrawals from one aquifer can affect heads in the other
- Number of wells used to construct 2020 contours:
  - Chicot (173)
  - Evangeline (326)
  - Jasper (112)
Hydrologic section of the Gulf Coast aquifer system
2020 Gulf Coast Water-Level Altitude Map Series

1977 - 2020 Chicocto water-level altitude change
Contour interval: 20 feet
Range: 120 to 200
Water-level altitude values range from 128 ft of decline to 203 ft of rise
HGSD 1 - HGSD 2 - HGSD 3
FB A - FB B - All

Chicocto 1977 to 2020 Well Points

Chicocto 1977 to 2020 Contours
DIY7720
- 100 to 200 ft Rise
- 140 to 160 ft Rise
- 100 to 120 ft Rise
- 60 and 80 ft Rise
- 20 and 40 ft Rise
- 20 and 40 ft Decline
- 60 and 80 ft Decline
- 120 ft Decline

HGSD Area 3
HGSD Area 2
HGSD Area 1
FB Area A
FB Area B

2020 Gulf Coast Water-Level Altitude Map Series

2020 Evangeline Water-Level Altitude
Contour interval: 50 feet
Range: 200 to 450
Water-level altitude values range from 237 ft above datum to 252 ft below datum

Evangeline 2020 Altitude Well Points

Evangeline 2020 Altitude Contours
Evangeline 1990 - 2020 Water-Level Altitude Change
Contour interval: 40 feet
Range: -200 to 140
Water-level altitude changes range from 218 ft of decline to 130 ft of rise
HGSD 1 - HGSD 2 - HGSD 3
FB A - FB B - All
Evangeline 1990 to 2020 Contours
Contour
- 120 ft Rise
- 40 ft Rise
- 20 ft Rise
- 10 ft Rise
- 0
- 20 ft Decline
- 40 ft Decline
- 120 ft Decline
Evangeline 1990 to 2020 Well Points

2020 Gulf Coast Water-Level Altitude Map Series
Evangeline 1990 - 2020 Water-Level Altitude Change
Contour interval: 40 feet
Range: -200 to 140
Water-level altitude changes range from 218 ft of decline to 130 ft of rise
HGSD 1 - HGSD 2 - HGSD 3
FB A - FB B - All
Evangeline 1990 to 2020 Contours
Contour
- 10 ft Rise
- 120 ft Rise
- 40 ft Rise
- 20 ft Rise
- 10 ft Rise
- 0
- 20 ft Decline
- 40 ft Decline
- 120 ft Decline
Evangeline 1990 to 2020 Well Points

HGSD Area 1
HGSD Area 2
HGSD Area 3
FB Area A
FB Area B
1 year changes (2019 to 2020)
- Chicot: about 41% declines in the 1 to 10 ft range
- Evangeline: about 49% declines in the 1 to 10 ft range
- Jasper: about 49% declines in the 1 to 10 ft range

5 year changes (2015 to 2020)
- Chicot: about 57% rises in the 1 to 10 ft range
- Evangeline: about 27% rises in the 1 to 10 ft range and about 24% declines in the 1 to 10 ft range
- Jasper: about 65% greater than 10 feet of rise

Summary: Groundwater levels
- Chicot water-level altitudes since 1990 and 1977 show mostly rises (~64% and ~64%)
- Evangeline water-level altitudes since 1990 indicate mostly rises (~62%)
- Evangeline water-level altitudes since 1977 indicate mostly (~66%) declines
- Over the period of 2000 to 2020, about 99% of water-level altitudes in the Jasper aquifer have declined.
Mechanism of Compaction and Method of Measurement

- Mechanism of Compaction:
  - Permanent decrease in land-surface elevation caused by irreversible isostatic deformation

- Method of Measurement:
  - After long-term and sustained groundwater withdrawals, the resulting compaction of aquifer sediments is concentrated in the fine-grained silt and clay layers
  - Magnified view of granular silt and clay skeleton defining fluid-filled interstitial pore spaces that store groundwater
  - Rearranged and compacted granular silt and clay skeleton with reduced porosity and groundwater storage capacity

2020 Gulf Coast Water-Level Altitude Map Series
2020 Gulf Coast Water-Level Altitude Map Series

Cumulative Compaction (ft)

Texas City 0.094 ft.

Addicks 3.750 ft.

1 Year Compaction Data

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<th>Addicks</th>
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<th>BaytownShallow</th>
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Dec. 2018 to Dec. 2019
Summary: Compaction

For the Period December 2018 through December 2019

- Four (4) sites recorded uplift ranging from 0.001 ft to 0.017 ft.
- Nine (9) sites recorded compaction ranging from 0.004 ft to 0.044 ft.
- One (1) compaction site recorded no change
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