Groundwater Monitoring at Tower Landfill

Presented by Dr. Gabriel Iltis, PhD, PE

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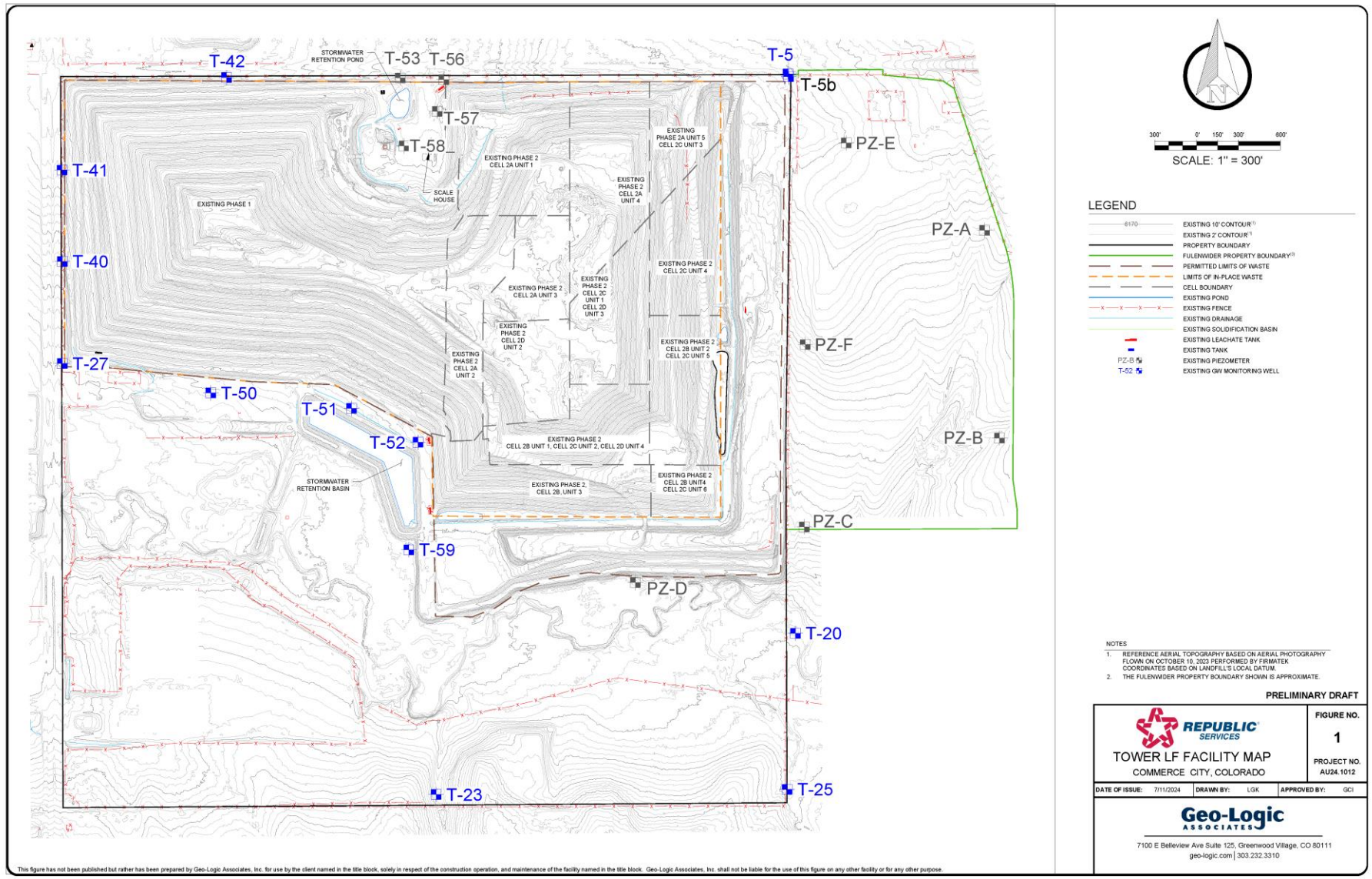
GROUNDWATER MONITORING NETWORK

Groundwater Monitoring Network

- 12 monitoring wells
- 11 piezometers

- Monitor for landfill impacts to groundwater
- Sampling and analysis conducted twice per year (semi-annually)
- Groundwater monitoring started in 1981



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GROUNDWATER FLOW: SECOND CREEK AQUIFER

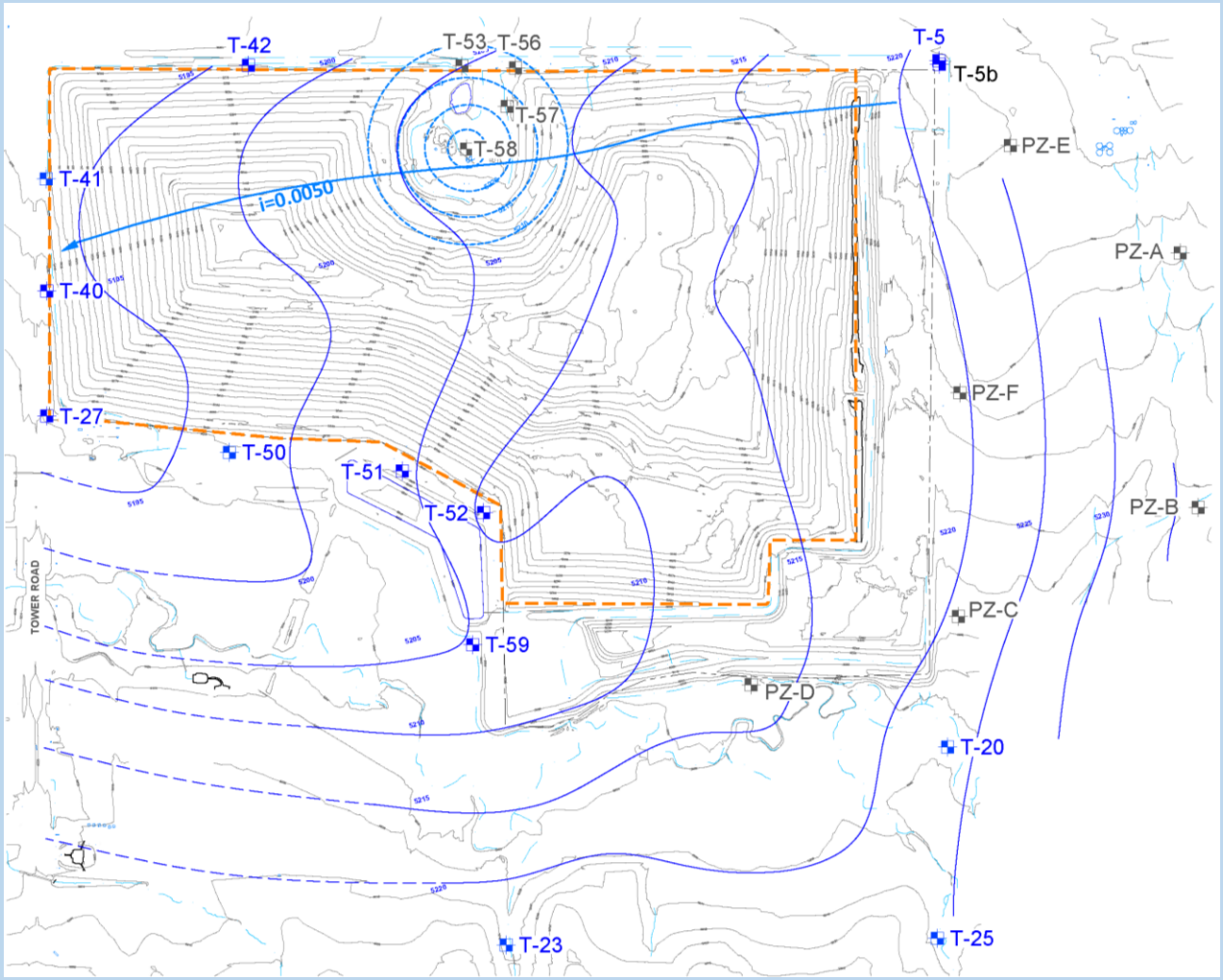
Site Soil

- Generally fine grained
  - Silty clay
  - Clayey to sandy silt
  - Low permeability

Groundwater Flow

- East to west below landfill footprint
- Flow velocity:
  - 0.26 to 3.98 feet per year

Potentiometric Surface Map: March 2024



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GROUNDWATER MONITORING AT TOWER LANDFILL

Groundwater Monitoring Regulatory Requirements

- 6 CCR 1007-2, Part 1, Appendix B
  - Groundwater sampling and analysis requirements
- 6 CCR 1007-2, Part 1, Appendix I
  - Constituent testing requirements (laboratory testing)
  - Groundwater sample testing includes:
    - Volatile organic compounds (VOCs)
      - E.g. BTEX, chlorinated solvents
    - Inorganic chemistry (anions, cations, metals)
    - General chemistry (pH, conductivity, temperature)
- No VOCs detected and water chemistry remains consistent with surficial aquifer water quality in the Denver Basin

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Thank You! Questions?

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6 CCR 1007-2, PART 1, APPENDIX I - DETECTION MONITORING CONSTITUENTS

Field Parameters	
Constituent	**Suggested Analytical Method**
pH, Field	Field Sampling
Specific Conductivity, Field	Field Sampling
Temperature, Field	Field Sampling
Total Organic Carbon (TOC)	SW-846 9060A

Cations	
Constituent	**Suggested Analytical Method**
Calcium, Total	SW-846 6010C
Magnesium, Total	SW-846 6010C
Potassium, Total	SW-846 6010C
Sodium, Total	SW-846 6010C

Anions	
Constituent	**Suggested Analytical Method**
Bicarbonate Alkalinity as $CaCO_3$	SM 2320B
Carbonate Alkalinity as $CaCO_3$	SM 2320B
Chloride	SW-846 9056
Nitrate as Nitrogren	USEPA 353.2
Nitrite as Nitrogen	USEPA 353.2
Sulfate	SW-846 9038

Metals	
Constituent	**Suggested Analytical Method**
Antimony, Total	SW-846 6010C
Arsenic, Total	SW-846 6020A
Barium, Total	SW-846 6010C
Beryllium, Total	SW-846 6010C
Cadmium, Total	SW-846 6010C
Chromium, Total	SW-846 6010C
Cobalt, Total	SW-846 6010C
Copper, Total	SW-846 6010C
Lead, Total	SW-846 6010C
Nickel, Total	SW-846 6010C
Selenium, Total	SW-846 6010C
Silver, Total	SW-846 6010C
Thallium, Total	SW-846 6020A
Vanadium, Total	SW-846 6010C
Zinc, Total	SW-846 6010C

Organic Constituents		
Constituent	**CAS Registry No.**	**Suggested Analytical Method**
1,1,1,2-Tetrachloroethane	630-20-6	SW-846 8260C
1,1,1-Trichloroethane (Methylchloroform)	71-55-6	SW-846 8260C
1,1,2,2-Tetrachloroethane	79-34-5	SW-846 8260C
1,1,2-Trichloroethane	79-00-5	SW-846 8260C
1,1-Dichloroethane (Ethylidene Chloride)	75-34-3	SW-846 8260C
1,1-Dichloroethylene (1,1-Dichloroethene; Vinyliden Chloride)	75-35-4	SW-846 8260C
1,2,3-Trichloropropane	96-18-4	SW-846 8260C
1,2-Dibromo-3-Chloropropane (DBCP)	96-12-8	SW-846 8260C
1,2-Dibromoethane (Ethylene Dibromide; EDB)	106-93-4	SW-846 8260C
1,2-Dichloroethane (Ethylene Dichloride)	107-06-2	SW-846 8260C
1,2-Dichloropropane (Propylene Dichloride)	78-87-5	SW-846 8260C
2-Hexanone (Methyl Butyl Ketone)	591-78-6	SW-846 8260C
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)	108-10-1	SW-846 8260C
Acetone	67-64-1	SW-846 8260C
Acrylonitrile	107-13-1	SW-846 8260C
Benzene	71-43-2	SW-846 8260C
Bromochloromethane (Chlorobromomethane)	74-97-5	SW-846 8260C
Bromodichloromethane (Dichlorobromomethane)	75-27-4	SW-846 8260C
Bromoform (Tribromomethane)	75-25-2	SW-846 8260C
Carbon Disulfide	75-15-0	SW-846 8260C
Carbon Tetrachloride	56-23-5	SW-846 8260C
Chlorobenzene	108-90-7	SW-846 8260C
Chloroethane (Ethyl Chloride)	75-00-3	SW-846 8260C
Chloroform (Trichloromethane)	67-66-3	SW-846 8260C
cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)	156-59-2	SW-846 8260C
cis-1,3-Dichloropropene	10061-01-5	SW-846 8260C

Organic Constituents (Continued)		
Constituent	**CAS Registry No.**	**Suggested Analytical Method**
Dibromochloromethane (Chlorodibromomethane)	124-48-1	SW-846 8260C
Ethylbenzene	100-41-4	SW-846 8260C
Methyl Bromide (Bromomethane)	74-83-9	SW-846 8260C
Methyl Chloride (Chloromethane)	74-87-3	SW-846 8260C
Methyl Ethyl Ketone (MEK; 2-Butanone)	78-93-3	SW-846 8260C
Methyl Iodide (Iodomethane)	74-88-4	SW-846 8260C
Methylene Bromide (Dibromomethane)	74-95-3	SW-846 8260C
Methylene Chloride (Dichloromethane)	75-09-2	SW-846 8260C
o-Dichlorobenzene (1,2-Dichlorobenzene)	95-50-1	SW-846 8260C
p-Dichlorobenzene (1,4-Dichlorobenzene)	106-46-7	SW-846 8260C
Styrene	100-42-5	SW-846 8260C
Tetrachloroethylene (Tetrachloroethene; Perchloroethylene)	127-18-4	SW-846 8260C
Toluene	108-88-3	SW-846 8260C
trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)	156-60-5	SW-846 8260C
trans-1,3-Dichloropropene	10061-02-6	SW-846 8260C
trans-1,4-Dichloro-2-butene	110-57-6	SW-846 8260C
Trichloroethylene (Trichloroethene)	79-01-6	SW-846 8260C
Trichlorofluoromethane (CFC-11)	75-69-4	SW-846 8260C
Vinyl Acetate	108-05-4	SW-846 8260C
Vinyl Chloride	75-01-4	SW-846 8260C
Xylenes, Total	1330-20-7	SW-846 8260C

Notes

SW-846: Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. July 2014.

SM: Standard Methods for the Examination of Water and Wastewater.

USEPA: Determination of Nitrate-Nitrite Nitrogen by Automated Colorimetry. Revision 2.0. August 1993.

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