CCR CAPABILITY BRIEFING

PROTECTING, ENHANCING, AND RESTORING THE ENVIRONMENT
CTI was founded in 1976 with a core focus on geotechnical engineering and geo-environmental science. Today, we provide an array of services countrywide to clients in the commercial, federal, state, and energy sectors.

Over the past 40 years, CTI has grown into a full-service project delivery firm specializing in the design and construction of waste disposal facilities and the execution of complex geotechnical projects. With nearly 100 professionals on staff, CTI maintains seven offices strategically located throughout the U.S. to provide the geographic reach and timely response our clients demand.

CTI also provides a wide range of expertise to electric generation facility clients including: containment facility siting, design, and permitting; construction phase engineering; construction quality assurance (CQA); and coal combustion residuals (CCR) management services.

Our CCR group is comprised of seasoned civil, geotechnical, and environmental engineers, certified geologists and hydrogeologists, and a variety of field services professionals. Together, this team has designed, inspected, repaired, and installed over 50 million square feet of Subtitle D synthetic and earthen landfill liner and cover systems since the early 1990’s.

CTI’s senior engineering team has extensive experience in the Research & Development (R&D) of modern liner and cover systems for waste containment facilities; specifically, in establishing an advanced analytical procedure approved by regulators for determining the stability and integrity of landfill and surface impoundment closure systems.

CTI engineers have extensive experience planning, designing, analyzing, monitoring, and inspecting landfill construction above existing landfills and impoundments. Key capabilities include:

- **Foundation Settlement Prediction, Analysis, and Design**
  - CTI pioneered a probabilistic, risk-based differential settlement analysis tool to calculate the distortions imposed on a composite cover system or composite liner system by large subsurface differential settlement or discontinuities. This tool was used to engineer the final cover system at the Maxey Flats Disposal Site Final Closure project in Kentucky, a CERCLA project to remediate a closed low-level radioactive waste (LLRW) landfill.

- **Global, Foundation, Waste, Liner System, and Side Slope Stability**
  - CTI geotechnical engineers are experienced in the analysis of slope stability for landfill permits, embankment design, staged construction planning, operations planning, and landslide remediation. These analyses consider numerous interim and final build-out conditions and consider the wide range of in-situ soil, waste impoundment, engineered fill, and geosynthetic interface conditions and interactions.

- **Side Slope (Veneer) and Subgrade Reinforcement**
  - CTI engineers were responsible for the design and inspection of the largest ever geocell-reinforced slope cover system in the world – the I-99 acid rock drainage remediation project near State College, PA. This veneer stabilization project is an example of the extraordinary results our geotechnical and geosynthetic engineering experts can deliver to unique projects. CTI has also designed and inspected numerous geosynthetic-reinforced subgrades over fly-ash ponds, peat deposits, and other highly-compressible and unstable subgrades.

- **Leachate Removal and Collection System Performance Enhancement**
  - CTI landfill engineers have introduced numerous performance enhancing and cost reducing features to the design of leachate collection systems. A good example is CTI’s state-of-the-art design for a continuous recirculation/agitation system for the leachate sump and a cleaning mechanism for the perforated sump riser. This design greatly increases system reliability by reducing the chance of clogging.

CTI is a Nationally Accredited Minority Business Enterprise (MBE)
CTI was founded in 1976 with a core focus on geotechnical engineering and geo-environmental science. Today, we provide an array of services countrywide to clients in the commercial, federal, state, and energy sectors.

Over the past 40 years, CTI has grown into a full-service project delivery firm specializing in the design and construction of waste disposal facilities and the execution of complex geotechnical projects. With nearly 100 professionals on staff, CTI maintains eight offices strategically located throughout the U.S. to provide the geographic reach and timely response our clients demand.

CTI also provides a wide range of expertise to electric generation facility clients including: containment facility siting, design, and permitting; construction phase engineering; construction quality assurance (CQA); and coal combustion residuals (CCR) management services.

Our CCR group is comprised of seasoned civil, geotechnical, and environmental engineers, certified geologists and hydrogeologists, and a variety of field services professionals. Together, this team has designed, inspected, repaired, and installed over 50 million square feet of Subtitle D synthetic and earthen landfill liner and cover systems since the early 1990’s.

CTI’s senior engineering team has extensive experience in the Research & Development (R&D) of modern liner and cover systems for waste containment facilities; specifically, in establishing an advanced analytical procedure approved by regulators for determining the stability and integrity of landfill and surface impoundment closure systems.

CTI engineers have extensive experience planning, designing, analyzing, monitoring, and inspecting landfill construction above existing landfills and impoundments.

Key capabilities include:

- **Foundation Settlement Prediction, Analysis, and Design**: CTI pioneered a probabilistic, risk-based differential settlement analysis tool to calculate the distortions imposed on a composite cover system or composite liner system by large subsurface differential settlement or discontinuities. This tool was used to engineer the final cover system at the Maxey Flats Disposal Site Final Closure project in Kentucky, a CERCLA project to remediate a closed low-level radioactive waste (LLRW) landfill.

- **Global, Foundation, Waste, Liner System, and Side Slope Stability**: CTI geotechnical engineers are experienced in the analysis of slope stability for landfill permits, embankment design, staged construction planning, operations planning, and landslide remediation. These analyses consider numerous interim and final build-out conditions and consider the wide range of in-situ soil, waste impoundment, engineered fill, and geosynthetic interface conditions and interactions.

- **Side Slope (Veneer) and Subgrade Reinforcement**: CTI engineers were responsible for the design and inspection of the largest ever geocell-reinforced slope cover system in the world – the I-99 acid rock drainage remediation project near State College, PA. This veneer stabilization project is an example of the extraordinary results our geotechnical and geosynthetic engineering experts can deliver to unique projects. CTI has also designed and inspected numerous geosynthetic-reinforced subgrades over fly-ash ponds, peat deposits, and other highly-compressible and unstable subgrades.

- **Leachate Removal and Collection System Performance Enhancement**: CTI landfill engineers have introduced numerous performance enhancing and cost reducing features to the design of leachate collection systems. A good example is CTI’s state-of-the-art design for a continuous recirculation/agitation system for the leachate sump and a cleaning mechanism for the perforated sump riser. This design greatly increases system reliability by reducing the chance of clogging.
Portage landfill soil cap placement
Ohio Environmental Protection Agency (OEPA), OHIO

• Repairing extensive stormwater damage;
• Providing a properly constructed landfill soil cap;
• Designing and constructing engineered stormwater controls;
• Addressing hydrostatic leachate outbreaks.

CTI conducted a broad geotechnical investigation of the existing 292-acre landfill (dry-stacked ash over sluiced ash) using cone penetration test with pore pressure measurements (piezocone or CPTu), downhole seismic shear wave velocity, soil borings with standard penetration tests and Shelby tube samples, laboratory index testing, and laboratory strength testing.

CTI provided Wexford County with comprehensive environmental, engineering, and program management services at the 196-acre RCRA Subtitle D landfill.

• Supported landfill operations through waste disposal cell expansions, operational enhancements, system upgrades, and environmental monitoring of air, stormwater, and groundwater.
• Characterized a 1-mile long, 2,500 feet wide, and 300 feet deep chlorinated solvent groundwater plume.
• Conducted waste relocation action (2 million cubic yards) to eliminate the source of contamination.
• Supported public meeting, media coverage and coordinated interim clean water supply.
• Implemented the remedy that included installation and construction of a $2M public water supply and conveyance system.

JC Weadock Landfill Engineering Study
Consumers Energy Company, Michigan

CTI successfully executed a design-build contract for a 30-acre orphaned landfill remediation project in northeast Ohio. Tasked with the challenge of providing an acceptable design to the Ohio EPA for:

• Conducting a broad geotechnical investigation of the existing 292-acre landfill (dry-stacked ash over sluiced ash) using cone penetration test with pore pressure measurements (piezocone or CPTu), downhole seismic shear wave velocity, soil borings with standard penetration tests and Shelby tube samples, laboratory index testing, and laboratory strength testing.

• Developed and presented six (6) viable options for consideration (including both on and off-site solutions) to address landfill relocation, operation, and final closure alternatives.

• Provided a comprehensive Environmental Study, including 30% design, stability analyses, and cost projections, to support Consumers Energy’s decision-making process.

Portage Landfill Soil Cap Placement
Ohio Environmental Protection Agency (OEPA), Ohio

CTI successfully executed a design-build contract for a 30-acre orphaned landfill remediation project in northeast Ohio. Tasked with the challenge of providing an acceptable design to the Ohio EPA for:

• Repairing extensive stormwater damage;
• Providing a properly constructed landfill soil cap;
• Designing and constructing engineered stormwater controls;
• Addressing hydrostatic leachate outbreaks.

Wexford County Landfill
Wexford County Department of Public Works, Michigan

CTI provided Wexford County with comprehensive environmental, engineering, and program management services at the 196-acre RCRA Subtitle D landfill.

• Supported landfill operations through waste disposal cell expansions, operational enhancements, system upgrades, and environmental monitoring of air, stormwater, and groundwater.
• Characterized a 1-mile long, 2,500 feet wide, and 300 feet deep chlorinated solvent groundwater plume.
• Conducted waste relocation action (2 million cubic yards) to eliminate the source of contamination.
• Supported public meeting, media coverage and coordinated interim clean water supply.
• Implemented the remedy that included installation and construction of a $2M public water supply and conveyance system.
Portage landfill soil cap placement

Ohio Environmental Protection Agency (OEPA), OHIO

Wexford County Landfill

- Repairing extensive stormwater damage;
- Providing a properly constructed landfill soil cap;
- Designing and constructing engineered stormwater controls;
- Addressing hydrostatic leachate outbreaks.

CTI conducted a broad geotechnical investigation of the existing 292-acre landfill (dry-stacked ash over sluiced ash) using cone penetration test with pore pressure measurements (piezocene or CPTu), downhole seismic shear wave velocity, soil borings with standard penetration tests and Shelby tube samples, laboratory index testing, and laboratory strength testing.

- Developed and presented six (6) viable options for consideration (including both on and off-site solutions) to address landfill relocation, operation, and final closure alternatives.
- Provided a comprehensive Engineering Study, including 30% design, stability analyses, and cost projections, to support Consumers Energy’s decision-making process.

CTI provided Wexford County with comprehensive environmental, engineering, and program management services at the 196-acre RCRA Subtitle D landfill.

- Supported landfill operations through waste disposal cell expansions, operational enhancements, system upgrades, and environmental monitoring of air, stormwater, and groundwater.
- Characterized a 1-mile long, 2,500 feet wide, and 300 feet deep chlorinated solvent groundwater plume.
- Conducted waste relocation action (2 million cubic yards) to eliminate the source of contamination.
- Supported public meeting, media coverage and coordinated interim clean water supply.
- Implemented the remedy that included installation and construction of a $2M public water supply and conveyance system.

Wexford County Landfill

Wexford County Department of Public Works, Michigan

CTI successfully executed a design-build contract for a 30-acre orphaned landfill remediation project in northeast Ohio. Tasked with the challenge of providing an acceptable design to the Ohio EPA for:

- Conducting waste relocation action (2 million cubic yards) to eliminate the source of contamination.
- Providing a properly constructed landfill soil cap;
- Designing and constructing engineered stormwater controls;
- Addressing hydrostatic leachate outbreaks.

JC Weadock Landfill Engineering Study

Consumers Energy Company, Michigan

CTI provided Consumers Energy with a comprehensive study to identify the feasibility of siting, engineering, and permitting different solutions for a long-term CCR management program at the facility.

- CTI conducted a broad geotechnical investigation of the existing 292-acre landfill (dry-stacked ash over sluiced ash) using cone penetration test with pore pressure measurements (piezocene or CPTu), downhole seismic shear wave velocity, soil borings with standard penetration tests and Shelby tube samples, laboratory index testing, and laboratory strength testing.

- Developed and presented six (6) viable options for consideration (including both on and off-site solutions) to address landfill relocation, operation, and final closure alternatives.
- Provided a comprehensive Engineering Study, including 30% design, stability analyses, and cost projections, to support Consumers Energy’s decision-making process.

Wexford County Landfill

Wexford County Department of Public Works, Michigan

CTI provided Consumers Energy with a comprehensive study to identify the feasibility of siting, engineering, and permitting different solutions for a long-term CCR management program at the facility.

- CTI conducted a broad geotechnical investigation of the existing 292-acre landfill (dry-stacked ash over sluiced ash) using cone penetration test with pore pressure measurements (piezocene or CPTu), downhole seismic shear wave velocity, soil borings with standard penetration tests and Shelby tube samples, laboratory index testing, and laboratory strength testing.

- Developed and presented six (6) viable options for consideration (including both on and off-site solutions) to address landfill relocation, operation, and final closure alternatives.
- Provided a comprehensive Engineering Study, including 30% design, stability analyses, and cost projections, to support Consumers Energy’s decision-making process.

Portage Landfill Soil Cap Placement

Ohio Environmental Protection Agency (OEPA), Ohio
Stone armor placement in progress in the geocell cover system along I-99 near State College, PA. CTI designed and inspected this one-of-a-kind veneer stabilization system. The slope angle was 1(H):1(V) and was 350-ft long.

CTI geotechnical engineers conducted a horizontal inclinometer sounding along the perimeter berm of a 130-acre Michigan landfill. Using the data collected, they were able to successfully assess perimeter berm stability and to provide the project team with invaluable details regarding berm construction and fill operations.

A high-strength geotextile reinforcement layer being installed over a 30-foot deep peat deposit at the Eagle Valley Landfill Cell 11 Construction project in Lake Orion, MI. CTI designed, inspected, and monitored the subgrade reinforcement for this project. A 115-ft vertical landfill expansion was then successfully constructed over this peat deposit area.

The placement of earth pressure and settlement instruments about to be buried beneath the liner system at a commercial landfill in southeast MI. CTI geotechnical engineers installed and monitored the instruments to assess the efficacy of the subgrade reinforcement system and advised the project team regarding operations over the unstable subgrade.

CTI technicians setting up for a monitoring survey circuit during an ash pond stabilization project in Michigan. CTI was responsible for construction inspection, piezometer monitoring, and survey monitoring on this project.

A 35-foot deep one-pass trench machine installing an 8-inch HDPE subsurface drain with sand filter pack at a Subtitle D Landfill located in Lake Orion, MI. CTI designed and inspected the installation of this drainage system. The underdrain system provided gravity drainage to a saturated 10-acre sand layer up to 30 feet thick. CTI’s design allowed the entire footprint to be safely dewatered within 3 months.

A high-strength geotextile reinforcement layer installed over a fly ash pit at Smiths Creek Landfill in Saint Clair County, MI. CTI designed, inspected, and monitored the subgrade reinforcement for this project. A citizen’s drop-off facility was then successfully constructed over the ash disposal area.

This excerpt from a 3-dimensional slope stability analysis illustrates one of hundreds of failure scenarios analyzed by CTI in the safety evaluation of a large canyon impoundment in China. CTI engineers considered numerous slope configurations, seismic conditions, and complex site geometry to advise the owner regarding future construction and waste placement practices.

Stone armor placement in progress in the geocell cover system along I-99 near State College, PA. CTI designed and inspected this one-of-a-kind veneer stabilization system. The slope angle was 1(H):1(V) and was 350-ft long.
The placement of earth pressure and settlement instruments about to be buried beneath the liner system at a commercial landfill in southeast MI. CTI geotechnical engineers installed and monitored the instruments to assess the efficacy of the subgrade reinforcement system and advised the project team regarding operations over the unstable subgrade.

This excerpt from a 3-dimensional slope stability analysis illustrates one of hundreds of failure scenarios analyzed by CTI in the safety evaluation of a large canyon impoundment in China. CTI engineers considered numerous slope configurations, seismic conditions, and complex site geometry to advise the owner regarding future construction and waste placement practices.

CTI geotechnical engineers conducted a horizontal inclinometer sounding along the perimeter berm of a 130-acre Michigan landfill. Using the data collected, they were able to successfully assess perimeter berm stability and to provide the project team with invaluable details regarding berm construction and fill operations.

CTI technicians setting up for a monitoring survey circuit during an ash pond stabilization project in Michigan. CTI was responsible for construction inspection, piezometer monitoring, and survey monitoring on this project.

A high-strength geotextile reinforcement layer being installed over a 30-foot deep peat deposit at the Eagle Valley Landfill Cell 11 Construction project in Lake Orion, MI. CTI designed, inspected, and monitored the subgrade reinforcement for this project. A 115-ft vertical landfill expansion was then successfully constructed over this peat deposit area.

A 35-foot deep one-pass trench machine installing an 8-inch HDPE subsurface drain with sand filter pack at a Subtitle D Landfill located in Lake Orion, MI. CTI designed and inspected the installation of this drainage system. The underdrain system provided gravity drainage to a saturated 10-acre sand layer up to 30 feet thick. CTI's design allowed the entire footprint to be safely dewatered within 3 months.

Stone armor placement in progress in the geocell cover system along I-99 near State College, PA. CTI designed and inspected this one-of-a-kind veneer stabilization system. The slope angle was 1(H):1(V) and was 350-ft long.

A high-strength geotextile reinforcement layer installed over a fly ash pit at Smiths Creek Landfill in Saint Clair County, MI. CTI designed, inspected, and monitored the subgrade reinforcement for this project. A citizen’s drop-off facility was then successfully constructed over the ash disposal area.

This excerpt from a 3-dimensional slope stability analysis illustrates one of hundreds of failure scenarios analyzed by CTI in the safety evaluation of a large canyon impoundment in China. CTI engineers considered numerous slope configurations, seismic conditions, and complex site geometry to advise the owner regarding future construction and waste placement practices.
CORPORATE HEADQUARTERS
28001 Cabot Drive, Ste. 250, Novi, MI 48377
Toll free 800.284.8632
ph. 248.486.5100
fx. 248.486.5050
info@cticompanies.com
www.cticompanies.com

CONTACTS
Morgan Subbarayan. PE*
Business Strategy
msubbarayan@cticompanies.com
248.560.0731 (direct)

Te-Yang Soong, PhD, PE*
Geotechnical/Geosynthetic
tsoong@cticompanies.com
248.560.0726 (direct)

Terri Zick*
Compliance
tzick@cticompanies.com
248.560.0732 (direct)

Charlie Williams, PE*
Construction/Demolition
cwilliams@cticompanies.com
816.533.4239 (direct)

Joseph Brown, CIH
Health and Safety
jbrown@cticompanies.com
865.963.2118 (direct)

Robyn James
Business Development/Contract Management
rjames@cticompanies.com
248.560.0723 (direct)

*20+ years of RCRA Subtitle D experience

REPRESENTATIVE CLIENTS
CTI’s current mix of federal, state, municipal, and commercial clientele includes:

CTI and Associates, Inc. is a Small Disadvantaged Business Enterprise (DBE) and Nationally Accredited Minority Business Enterprise (MBE)