Engineer of Record – an Owner's perspective

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Types of TSF's

Existing / Historic Facilities / Acquisitions

- Often had no or little formal design (U/S construction)
- Geotechnical Investigations / assessments completed

New Facilities

- A firm or individual engineer leads design effort
- Evolution of a firm completing geotechnical work to individual point of contact

In both cases, the Ownership **RISK** needs to be managed.

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Timeline

Pre - EOR

- 1970-80's:
  - Many TSF's did not have thorough geotechnical design evaluations
- 1980's
  - Initiation of high(er) quality static and seismic evaluations
- 1990's
  - Well qualified consultants providing detailed geotechnical assessments (design engineer identified)

EOR - formalized

- 200x
  - EoR is evident, but not formalized
- 201x
  - EoR become formalized in Corporate Std & Guidance documents

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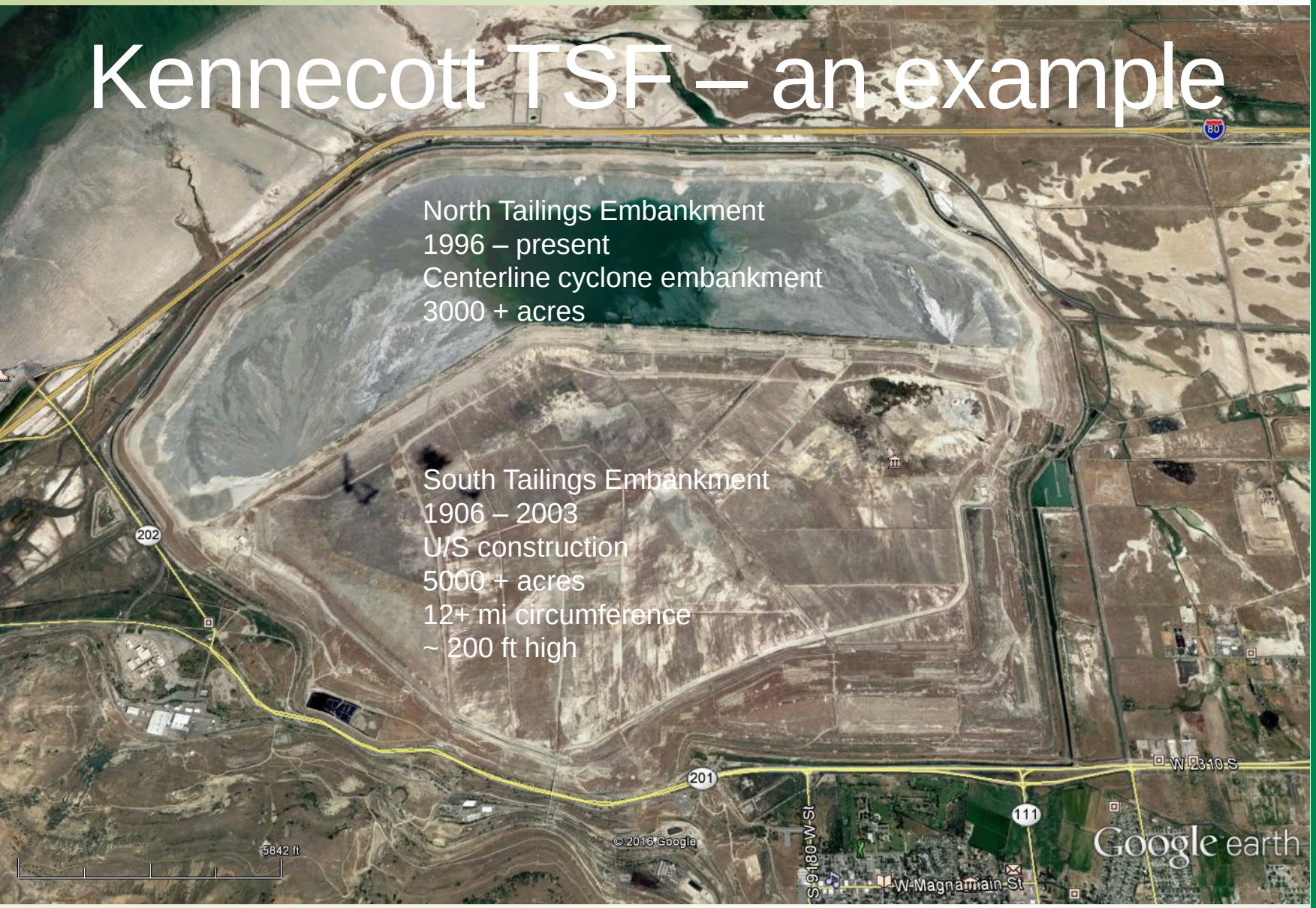
Kennecott TSF – an example



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Kennecott Tailings - example

- Pre-1940's – A Casagrande reviews isolated dike failures
- 1950's – IECO completes geotech inv @ two sections
- 1960's – WWC completes remedial investigation of decant failure
- 1970's – internal designs by KES
- 1980's –
  - D&M 1983 tailings modernization
  - Klohn Crippen – seismic evaluation
- 1990's
  - South Tailings - Significant internal / external investigation, design, mitigation
  - North Tailings Facility design by WWC
- 2000's
  - Design Engineer / EoR clearly identified

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Role Definitions

Role Descriptions / definitions are not uniform throughout industry:

- Engineer of Record / also termed the “Design Engineer”
  - These may not be the same definition with all groups
  - Former “design engineer” may not be the EoR
- Tailings Manager: overall responsibility for making sure “things get done”
- Qualified Site Representative / Tailings Superintendent
- Technical Representative

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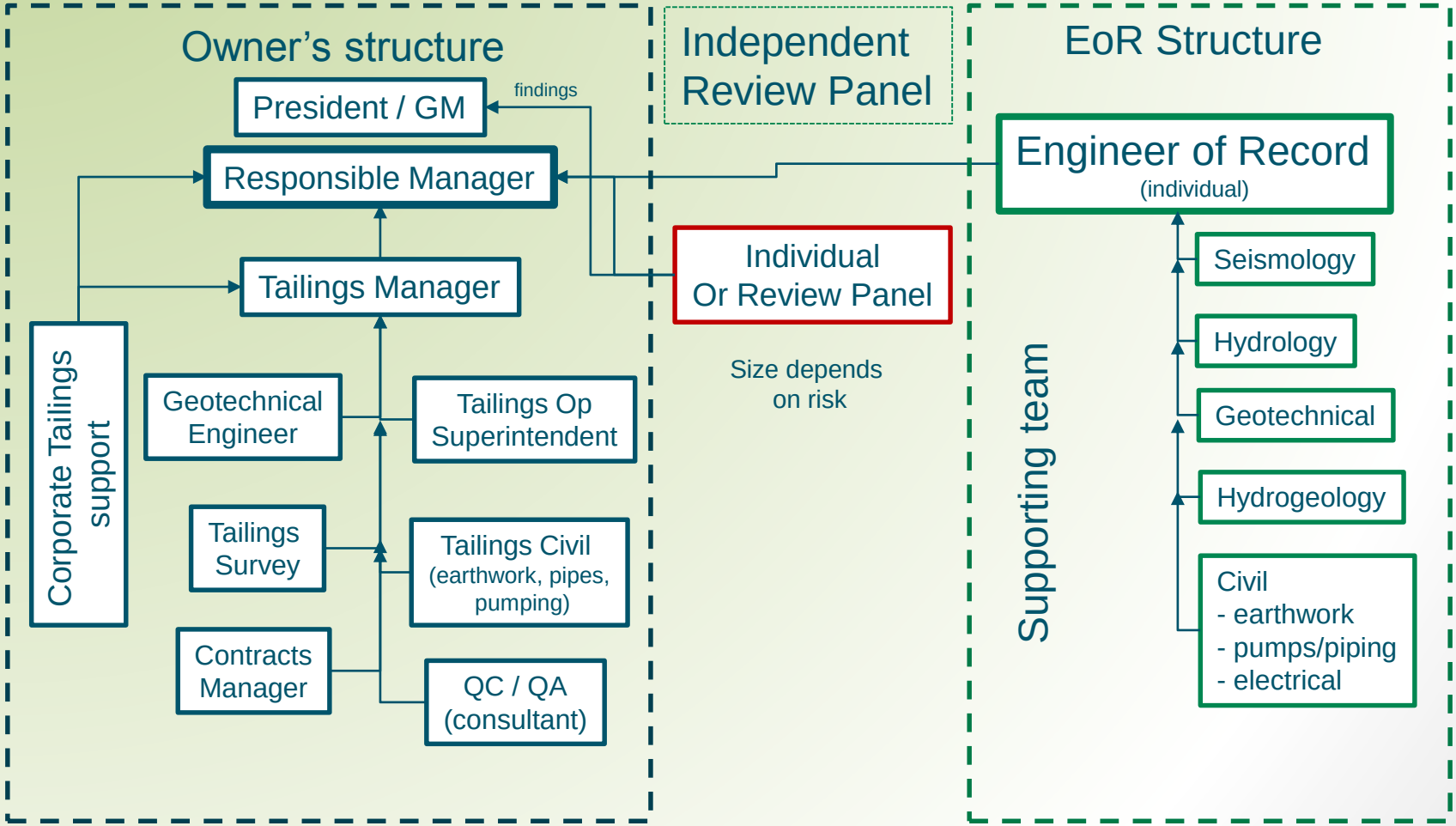
Organizational Structure (example)



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Elements of EOR Qualifications

- Education
  - Advanced degree (usual)
  - Specialty
- Training and Certifications
  - Professional Registration
  - Society Membership / participation
  - Experience (10+ years)

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Responsibilities

- Assurance for physical integrity, safety, behavior
- Approval / Technical Oversight of sub-discipline work
  - Site Characterization / seismicity
  - Geotechnical
  - Hydrologic
  - Hydraulic
- Approval of Design Modifications (MOC)
- Compliance / Preparation of OoM Manuals
- QA/QC review or acknowledgement
- Instrumentation Review
- Seismic Characterization
- Storm water management and controls

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Typical Deliverables

- Design Report and Analyses
- Drawings / Specifications
- Inspection Reports
- Instrumentation Reviews
- Annual Reviews
- Emergency Action Plans
- Compliance with OoM Manuals

Exclusions

- Environmental Compliance
- Groundwater Hydrology
- Air Quality and Emissions

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Conclusions

- The EOR is the lead for the number of disciplines needed for design and operation
  - Knowledgeable on all aspects of design
  - Relies on specific discipline leaders to technical input / advice
  - Communication with the Owner's team
- The EOR is one leg of risk management, that includes:
  - The EOR
  - The Owner's team
  - Independent review
- The concept of the EoR has evolved over time and is still evolving
  - depending on company, location, regulations

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