

Keeping It Clean

Water & Waste Water Design Keys



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Learning Objectives / Agenda

- Design Differences in 2/3 World and USA
 - Water Systems
 - Waste Water Systems
- Case Studies
 - Malongo Baptist Vocational School
 - Westminster Theological College
- Questions and Answers



Water System Design - Source

- USA
 - Municipal System (85% of population)
- Developing World
 - On Site Wells (39%)
 - Municipal System (31%)
 - Rainwater Collection (15%)
 - Spring (15%)



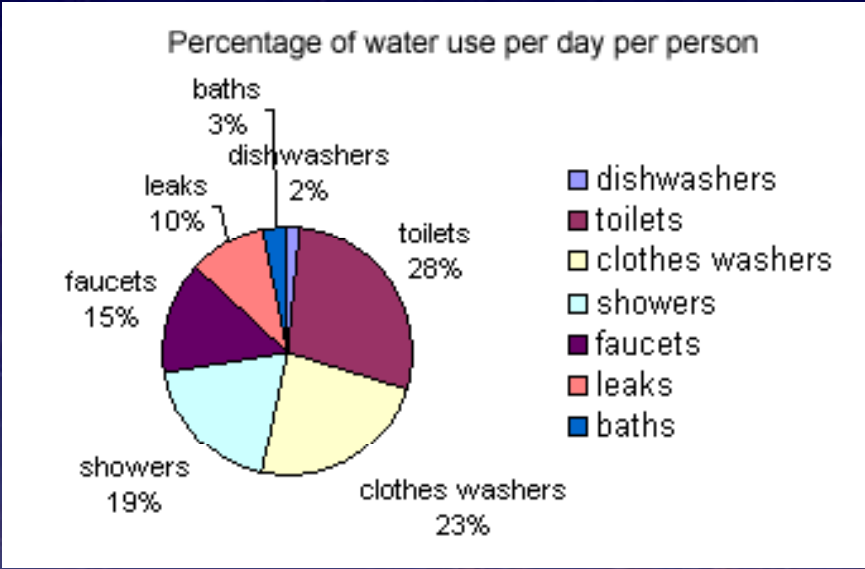
Water System Design – Demand

- USA
 - 135 GPD indoor usage
- Developing World
 - 37 GPD For fully plumbed dwelling
 - 13 GPD Minimum recommended
- Reasons for Differences
 - Washing Machine
 - 30 – 50 Gal / Load
 - Dishwasher
 - 5-15 Gal / Load
 - Faucets
 - 2.5+ GPM in USA
 - 0.8 GPM in Developed World

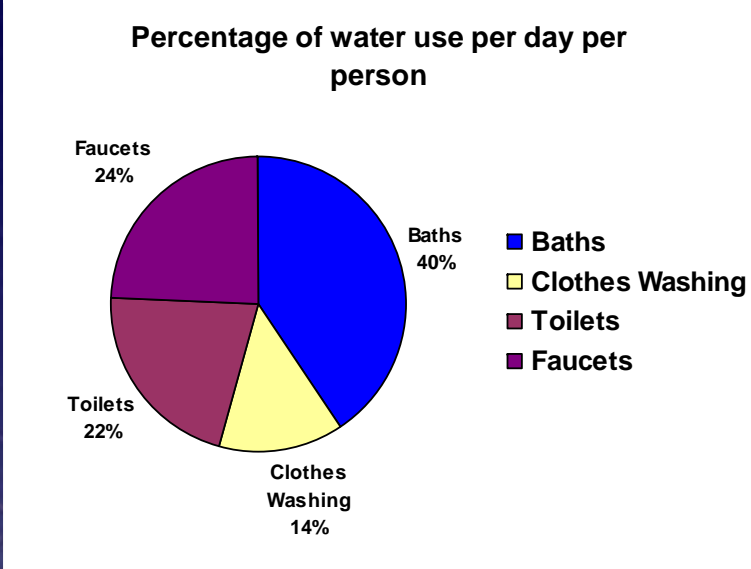


Water System Design – Demand

Developed World



Developing World



Source: City of Toronto



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Water System Design – Storage

- USA
 - Private Level
 - Not required for domestic or commercial applications
 - Municipal Level
 - Typically 2x Average Daily Demand + fire suppression
 - Many large storage tanks



Water System Design – Storage

- Developing World
 - Private Level
 - Seen in every project
 - Many times required by building code
 - Smaller tanks for 1-3 times ADD
 - Many smaller tanks
 - Municipal Level
 - Large storage tanks
 - Frequently run dry



Water System Design – Distribution

- USA

- Private Level

- Size determined by UPC
 - Typically pipe size 3-4” for commercial development, much smaller for residential uses

- Municipal Level

- Size determined by fire flow
 - Typically pipe size 8+”
 - 36” minimum pipe depth

- Developing World

- Private Level

- Size determined by need and domestic flow
 - Typical pipe size of ½” - 2”

- Municipal Level

- Size determined by domestic flow
 - Typical pipe size 2-3”
 - 0 - 12” typical pipe depth



Water System Design – Pressure

- USA

- Private Level

- Flow pressure at spigot 8 – 15 psi

- Municipal Level

- Distribution pipe 30 – 100 psi



- Developing World

- Private Level

- Typical range of 2 – 5 psi at fixtures

- Municipal Level

- 30 - 100 psi



Water System Design – Treatment

- USA
 - Private Level
 - None needed
 - Municipal Level
 - Extensive treatment provided for all water
 - Predominately chlorination
 - Some ultra violet



Water System Design – Treatment

- Developing World
 - Private Level
 - Point of source treatment
 - Ceramic filters
 - Ultra violet
 - Municipal Level
 - Treatment provided (similar to USA)
 - Possibly contaminated by the time it reaches the user due to poor distribution network



Water System Design

eMi Recommended Upgrades

- Properly designed storage tanks
- Adequately sized distribution lines
- Proper location of distribution network



Water System Design

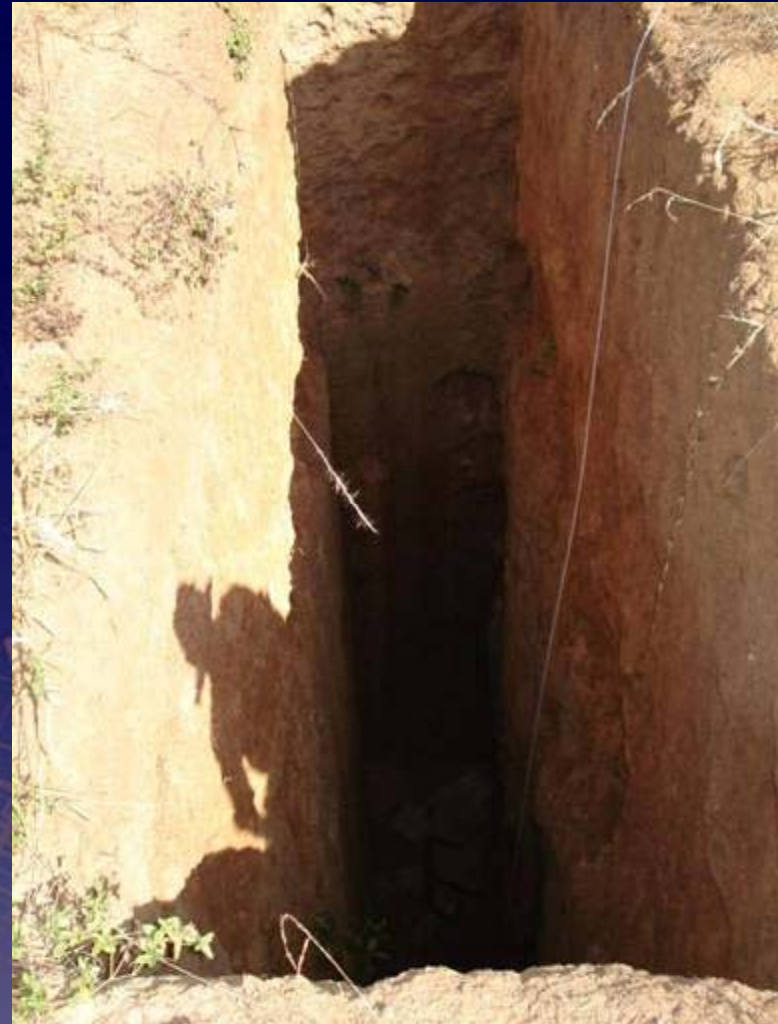
- Questions?



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Waste Water Design – System

- USA
 - Private Level
 - Flush toilets
 - Running showers
 - Kitchen sinks
 - Municipal Level
 - Community collection system
 - Developing World
- Developing World
 - Private Level
 - Pit latrines
 - Bucket baths
 - Jerry cans
 - Municipal Level
 - Rarely exists



Waste Water Design – Collection

- USA
 - Private Level
 - 4" Pipes
 - Municipal Level
 - 8" + Pipes
- Developing World
 - Private Level
 - 3" or 4" Pipes
 - Municipal Level
 - Usually doesn't exist



Waste Water Design – Treatment / Disposal

- USA
 - Private Level
 - Connect to municipal system
 - Municipal Level
 - Large scale treatment
- Developing World
 - Private Level
 - On-site treatment required
 - Typically pit latrine
 - Occasionally septic tank & soak pit
 - Inability to flush toilet paper
 - Municipal Level
 - Usually doesn't exist



Waste Water Design

eMi Recommended Upgrades

- Properly designed septic tanks
- Absorption facilities that are sized based on soil characteristics
- No contamination of the ground water
- No pit latrines if possible



Waste Water System Design

- Questions?



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Case Study – Malongo Baptist Vocational School

Background

- Existing School
- 50 boarding students
- 10 staff on-site
- Nearby wells
- Pit latrines

eMi Design

- 22 acre site master plan
- Boarding facilities for 200
- Rainwater collection
- Pit latrines

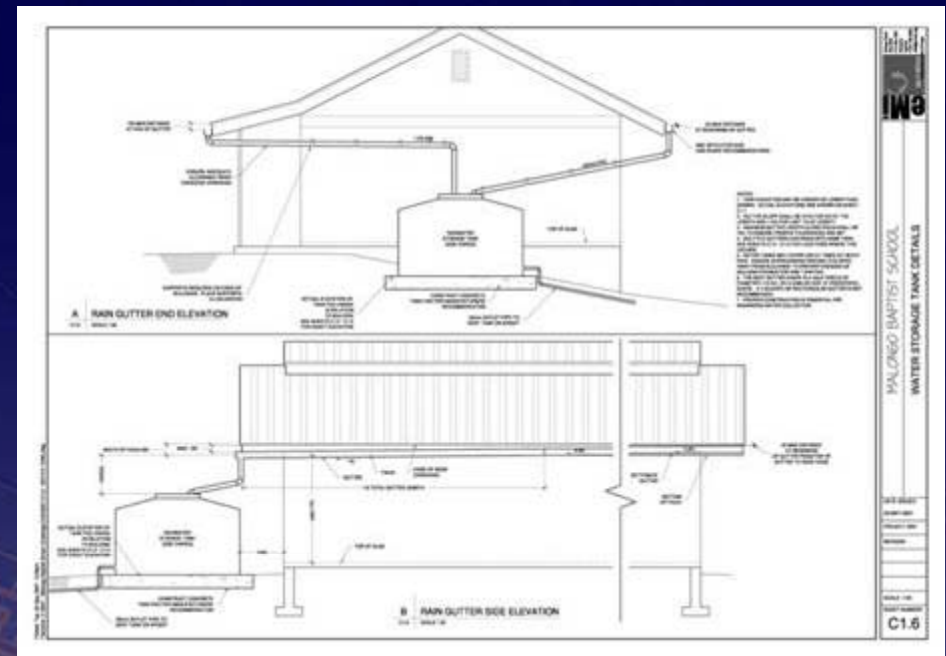


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Case Study – Malongo Baptist Vocational School

- Water Design
 - Source
 - Rainwater collection
 - Demand
 - Per person 8 gpd
 - Total 1,600 gpd
 - Storage
 - 48 Rainwater collection tanks
 - Total Storage Capacity
 - 94,000 gallons
 - 2 months



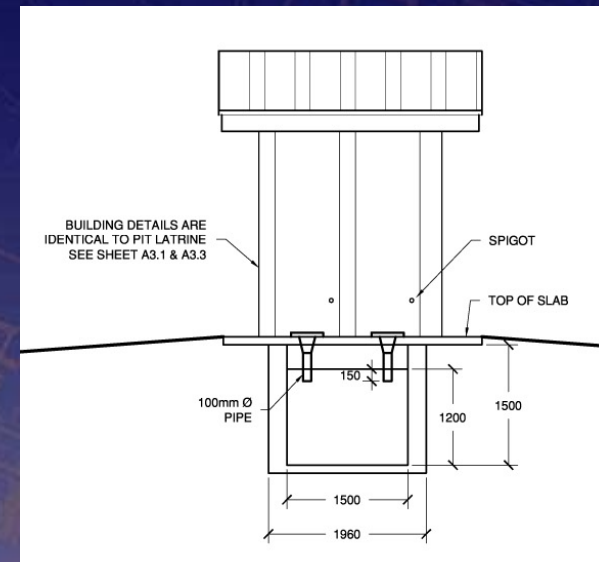
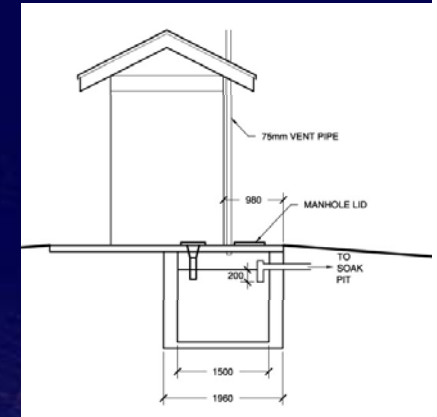
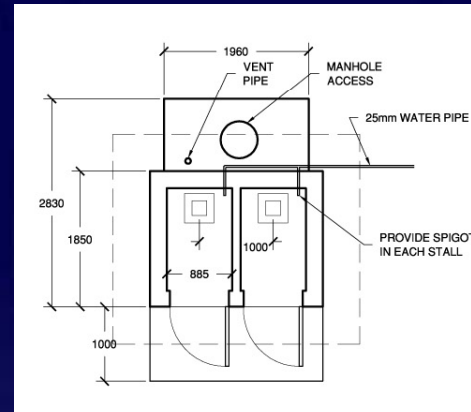
Case Study – Malongo Baptist Vocational School

- Water Design (cont.)
 - Distribution
 - 12 spigots placed near 4 dormitory blocks
 - No indoor plumbing
 - Pressure
 - 4 psi at each spigot
 - Treatment
 - None designed
 - Water to be boiled by user if required

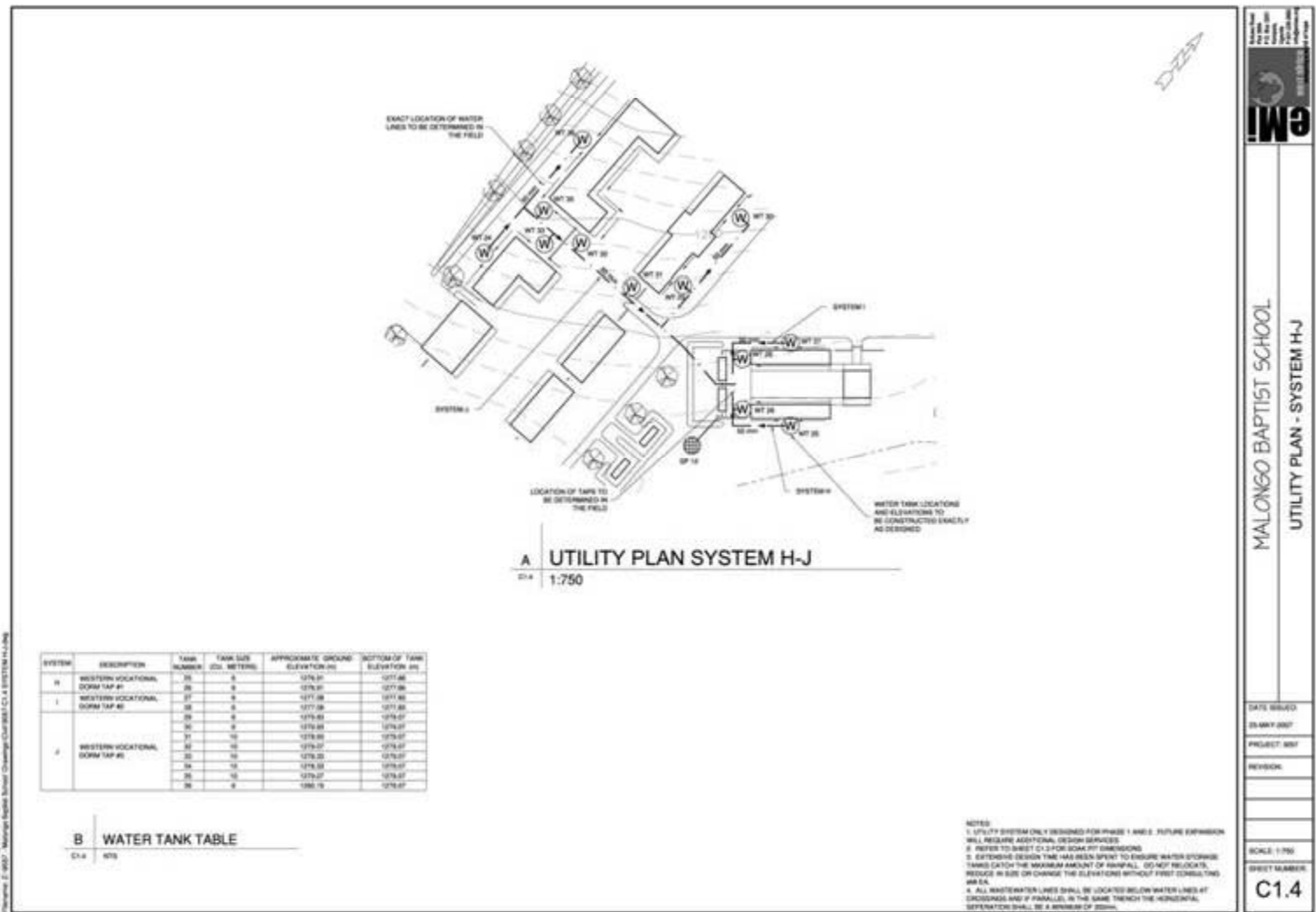


Case Study – Malongo Baptist Vocational School

- Waste Water Design
 - System
 - Pit latrines for students
 - Aqua-Privy for faculty
 - Collection
 - None required
 - Treatment / Disposal
 - Soak pit for aqua-privy
 - Long drop for pit latrine



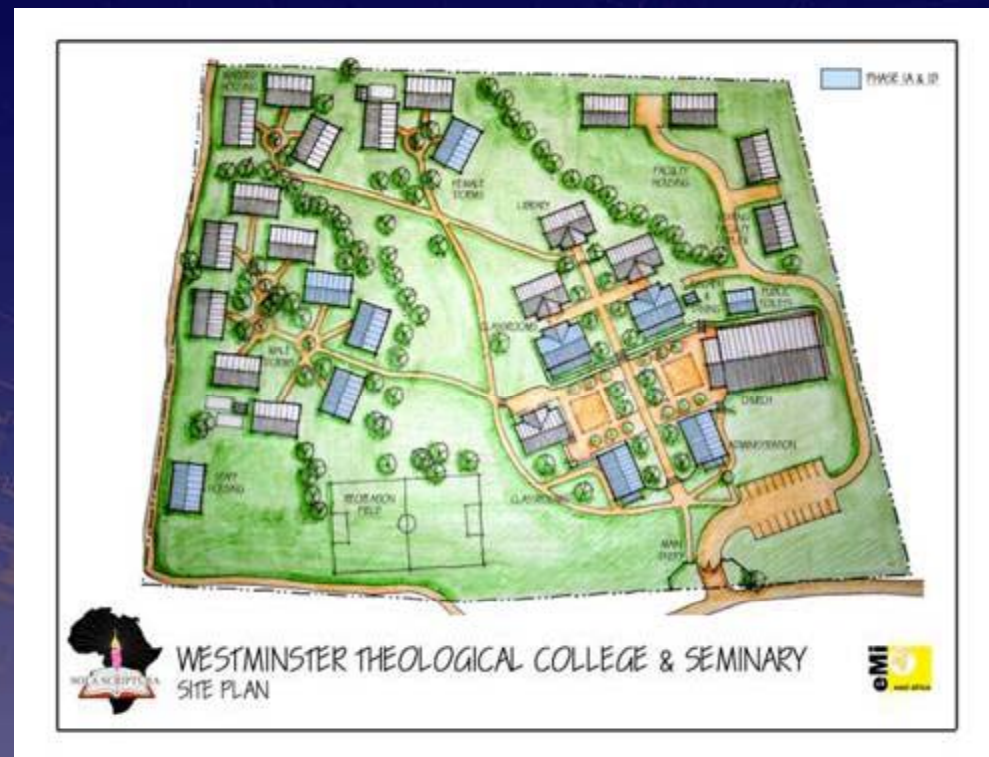
Case Study – Malongo Baptist Vocational School



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Case Study – Westminster Theological College

- Background
 - Undeveloped 10 acre site
 - Near Kampala
 - Architectural design
 - Boarding facilities for 200
 - Classrooms, dining, assembly hall
 - Staff housing



Case Study – Westminster Theological College

- Water Design
 - Source
 - Municipal supply
 - Demand
 - Per person 35 gpd
 - Total 10,000 gpd
 - Storage
 - 5 Storage tanks
 - Total storage capacity 8,700 gallons
 - Less than one day



Case Study – Westminster Theological College

- Water Design (cont.)
 - Distribution
 - Network of 1" to 2-1/2" pipes
 - Indoor plumbing
 - Pressure
 - 3 - 16 psi at the building
 - Treatment
 - None designed
 - Water to be boiled by user if required

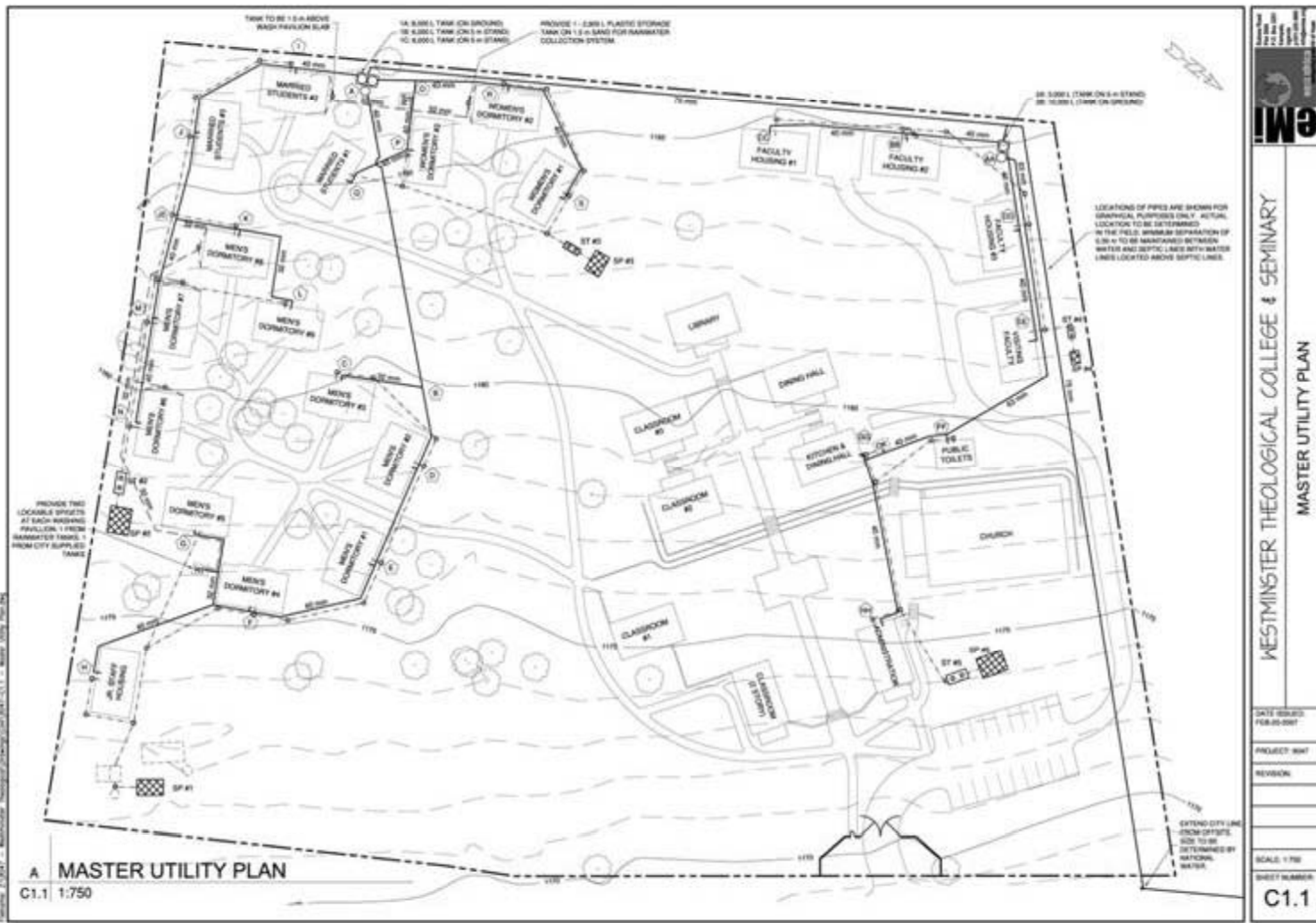


Case Study – Westminster Theological College

- Waste Water Design
 - System
 - Western style toilets
 - In-door plumbing
 - Collection
 - Limited to buildings in same phase
 - Treatment / Disposal
 - Septic tank
 - Soak pit



Case Study – Westminster Theological College



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Water & Waste Water Design Keys

- Questions?



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