

Design and Construction of a Wastewater Pump Station and Conveyance System

UW Civil Engineering 481
More Hall

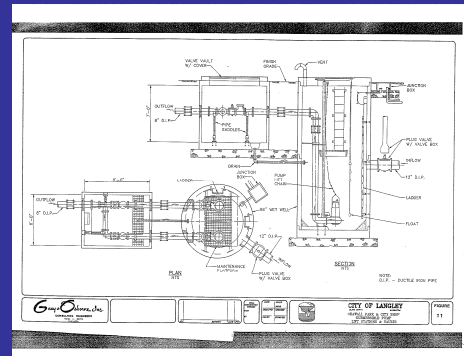
John P. Wilson, P.E.
November 7, 2008



Common Pump Station Types

- Submersible
- Wet pit/Dry pit
- Wet well mounted

Submersible Pump Station



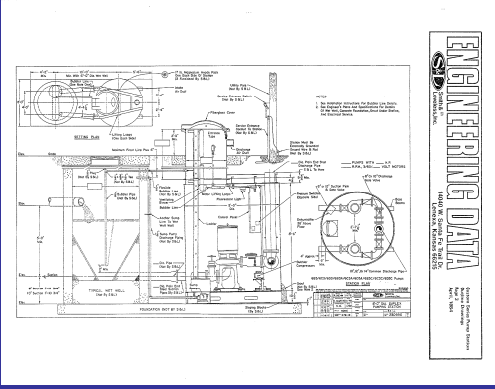
Submersible Pump Station



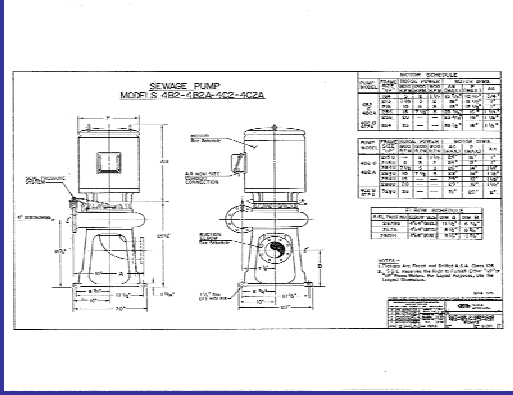
Submersible Pump Station Wet Well



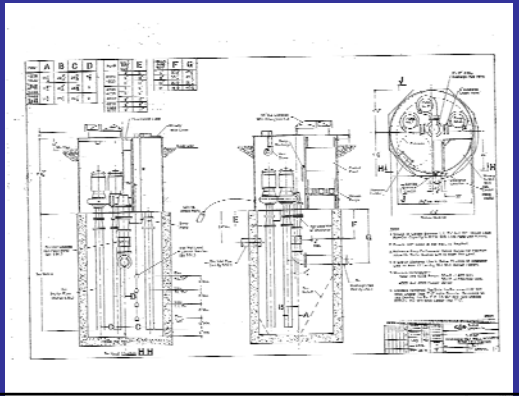
Wet Pit/Dry Pit Pump Station



Non Clog Sewage Pump



Wet Well Mounted Pump Station

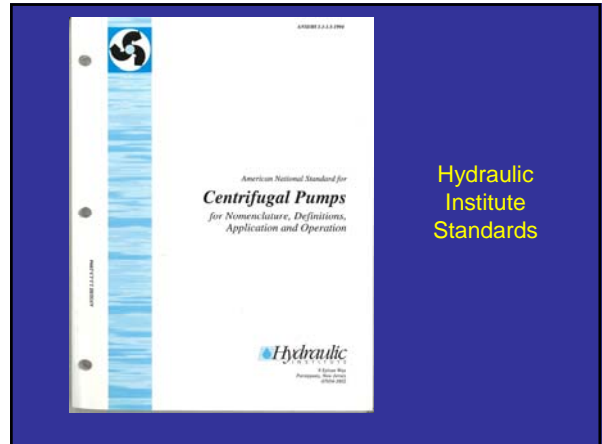
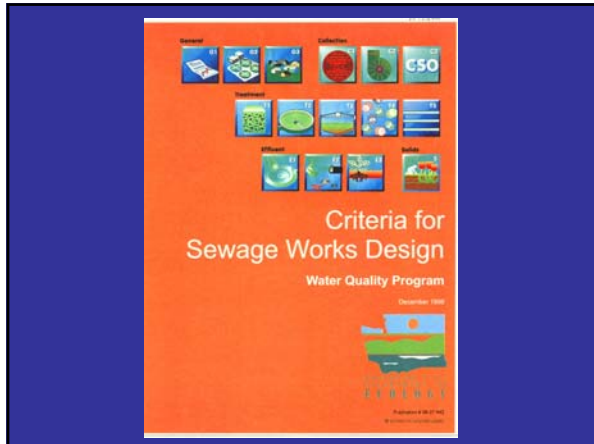


Wet Well Mounted Pump Station

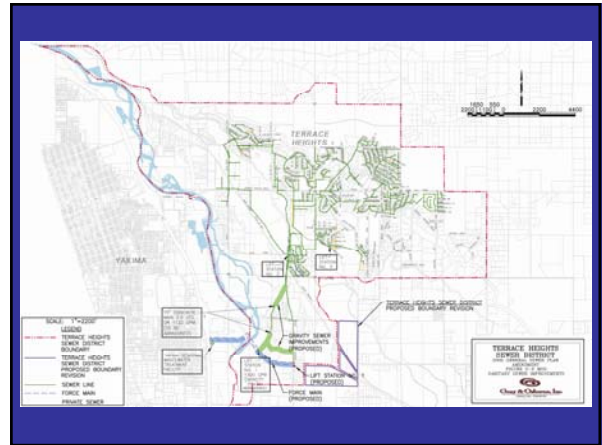
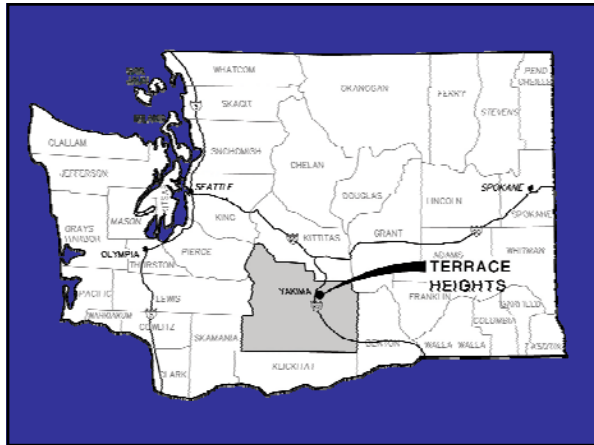


Pump Station Design Standards

- Criteria for Sewage Works Design (Department of Ecology)
- Industry Standards (design manuals, text books)
- Manufacturer's Standards
- Hydraulic Institute
- City design standards
- International Building Code (IBC)
- National Electric Code (NEC)
- National Fire Protection Association (NFPA)



Hydraulic
Institute
Standards



Terrace Heights Sewer District
Sewerage System Improvements

AREA FLOW VOLUMES

THSD

Peak Hour Peaking Factor: 3.0
Proposed Annual Design Flow: 1.000 cfs (28.3 L/s)

Parameter	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Peak Flow (cfs)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Peak Flow (L/s)	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3

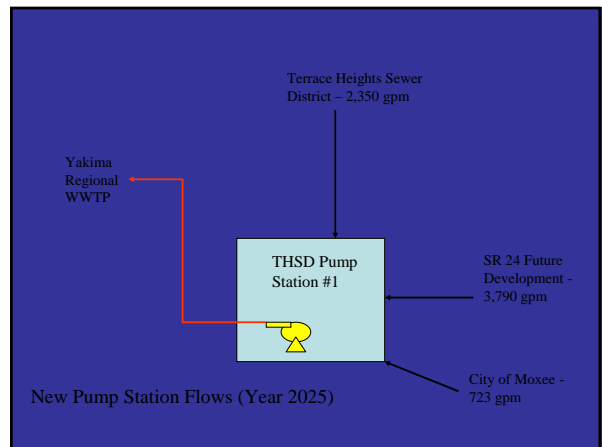
City of Moxee

Total Inflow and Area
Proposed Peak and Area
Peak Hour Peaking Factor

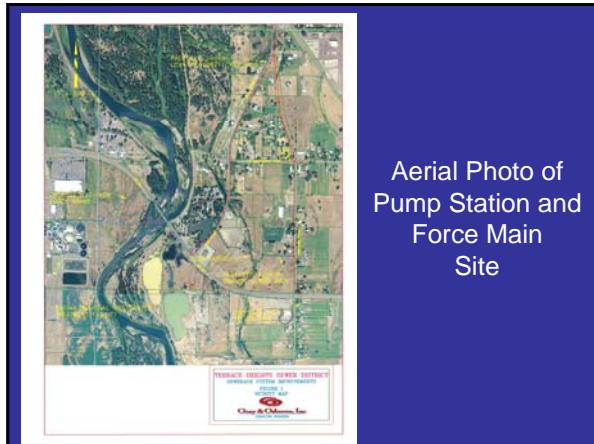
Parameter	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Peak Flow (cfs)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Peak Flow (L/s)	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3

Area Flow Volumes 1 of 1

Design Flow
Calculations



New Pump Station Flows (Year 2025)



Pump Station Design Steps

- Service area (zoning, population, commercial/industry)
- Design peak flow (average flow X peaking factor + I&I) (20-year projection)
- Pump station location/elevation
- Gravity sewer diameter, material, slope, alignment
- Force main diameter, length, material, alignment, elevation change
- Pump design flow and TDH
- Pump type, model, and quantity

Pump Station Design Steps (cont'd)

Motor speed and control

- Pump station type and features
- Pump room layout
- Wet well design
- Electrical system incl. auxiliary power
- HVAC and odor control

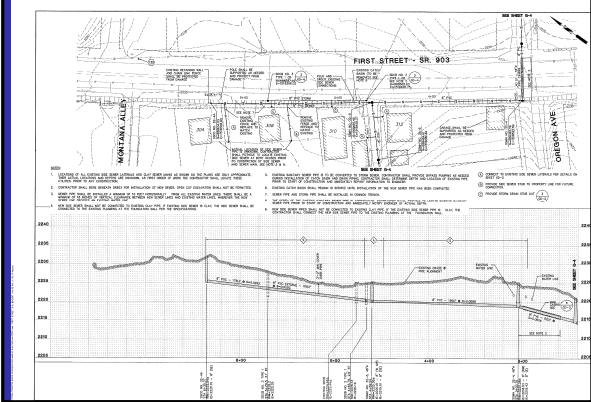
Sewer and Force Main Hydraulic Calculations

- Open channel gravity flow:
use Mannings Equation
 $V = (1.486/n)R^{2/3}S^{1/2}$
- Full pipe pressure flow:
use Hazen-Williams Equation
 $H_f = 10.44LQ^{1.85}/C^{1.85}d^{4.8655}$

Force Main Calculations

Total Dynamic Head Calculation

Sewer Plan and Profile



Gravity Sewer Installation



48-inch Concrete Sewer Manhole



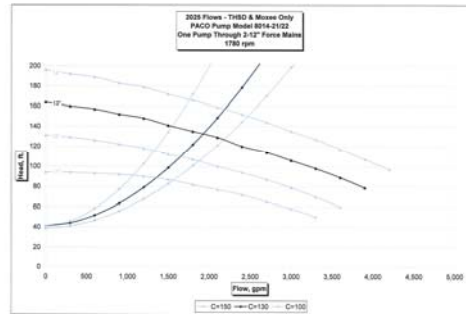
Manhole interior

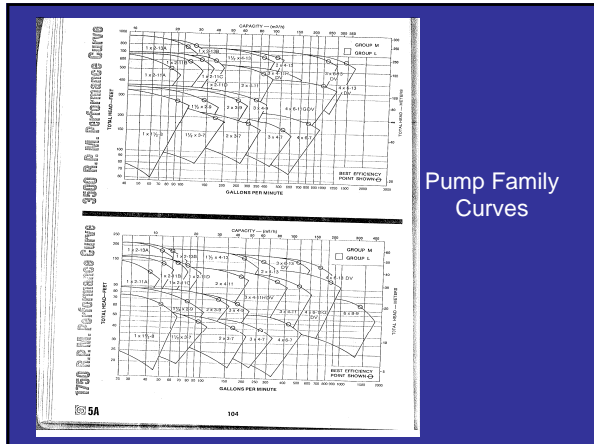


Force Main Installation

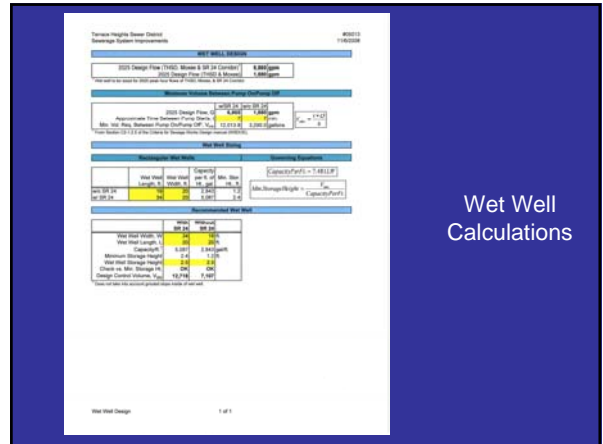


Pump System Curve

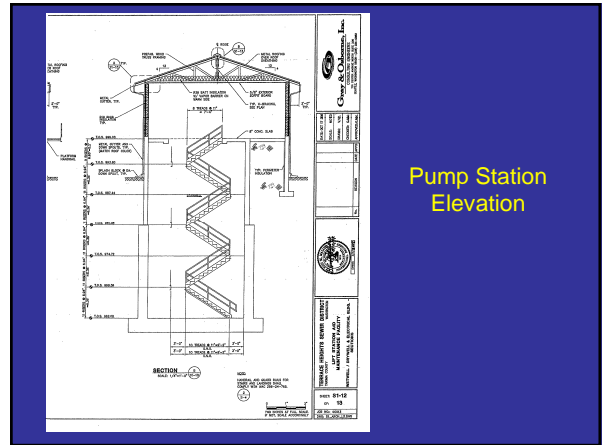
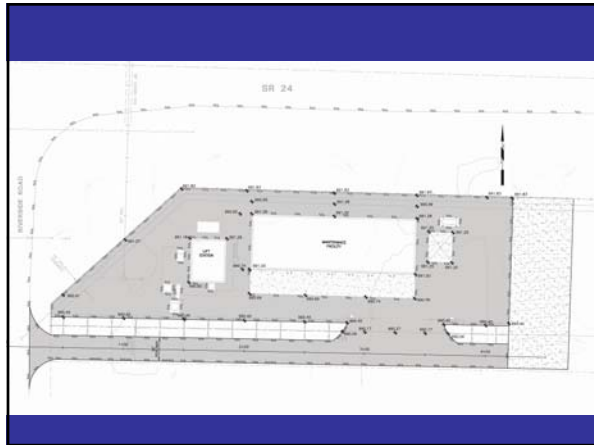




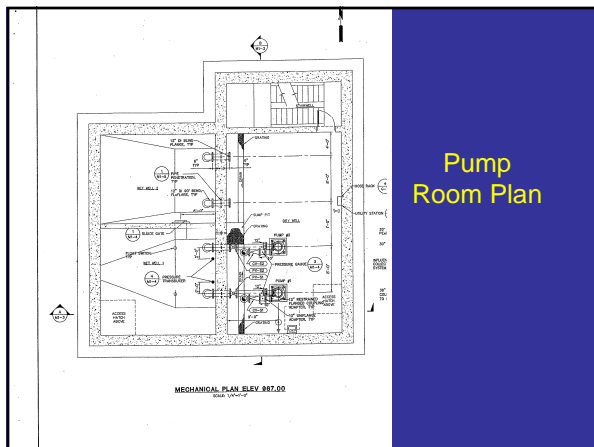
Pump Family Curves



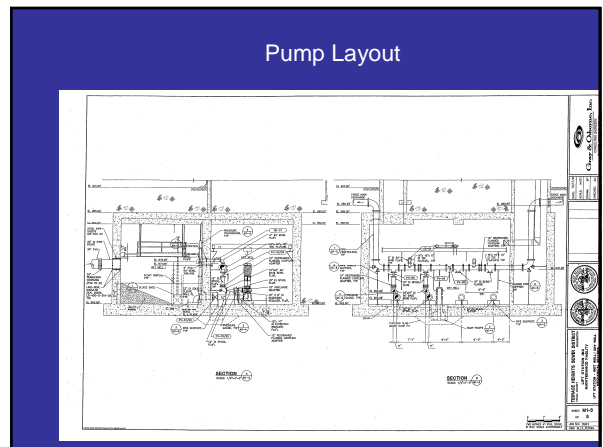
Wet Well Calculations



Pump Station Elevation



Pump Room Plan



Pump Layout





