Design of Water Distribution Network Using Water Cad

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MAY 2011

Submitted in partial fulfillment of the Degree of

Bachelor of Technology

DEPARTMENT OF CIVIL ENGINEERING

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

CONTENTS

CERTIFICATE

This is to certify that the work entitled, "Design of Water Distribution Network Using Water Cad" has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for award of this or any other degree or diploma.

Supervisor

Mr. Abhishek Chakraborty
Civil Engineering Department
Jaypee University of Information Technology

Certified the above mentioned project work has been carried out by the said group of students.

26/5/11

(Dr. Ashok Gupta)
Head of Department
Jaypee University of Information Technology
Solan, Waknaghat

CANDIDATE'S DECLARATION

We hereby certify that the work which is being presented in this report, "Design of Water Distribution Network Using Water Cad" in partial fulfillment of the requirement for the award of B.Tech degree, submitted in the Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat is an authentic record of our own work carried out from July 2010 to May 2011 under the guidance of Mr.Abhishek Chakraborty, Lecturer in Civil Engineering Department. We have not submitted the matter embodied in the report for the award of any other degree.

Pradeep Angiras

Sahil Dev

Umesh Sharma

Siddharth Dutt

ACKNOWLEDGEMENT

The satisfaction that accompanied the successful completion of any task would be incomplete mentioning the people who made it possible and whose guidance and encouragement served as an oasis in the desert and crowned our efforts with success.

Its a great pleasure and moment of immense satisfaction for us to express our profound gratitude to our mentor **Mr. Abhishek Chakraborty** whose kind cooperation, dynamic guidance, active involvement and constant motivation in the proceedings in the project right from the beginning, has greatly helped us in realizing our study project. Working under his guidance has been an opportunity for us to learn more and more.

We are also grateful to our Head of Department **Dr. Ashok Gupta** whose boosting attitude and incredible co-operation was a great support to the perseverance we had put in during our project.

We feel short of words to express thanks to all faculty of Civil Engineering Department, our seniors and Batch fellows, who have contributed directly or indirectly in this project to complete the dissertation work successfully.

Finally, by no means least, we owe special thanks and indebt to our respective family members for the moral support and affection. Their blessings are the most important strength, which always lighted our path towards success.

This section is a vote of thanks and gratitude towards all those persons who have directly or indirectly contributed in their own special way towards the completion of this project.

\- Project Team

Pradeep Angiras **Sahil Dev**

Umesh Sharma **Siddhrath Dutt**

ABSTRACT

We have used loop system in our network to ensure proper distribution of water quality wise and quantitatively. We have taken design period as 30years. We have assigned unit demand as 120 lpcd. We have carried out steady state and EPS.

The problem encountered by us during our project work are

Assigning proper diameter to pipes

Assigning pump definition

Defining tank variables

Maintaining pressure head at junctions

We overcome problems with help of our expert guidance from our project guide Mr Abhishek Chakraborty

Chapter 1

Water Distribution System Design Criteria and Planning

Contents:

1. Types of distribution systems and Network Configurations
2. Water Supply and demand
3. Useful models for water distribution system design (WaterCad)

Types of distribution systems

The most common types are:

1. Gravity supply: The source of supply is at a sufficient elevation above the distribution area (consumers)

- No energy costs.
- Simple operation
- Low maintenance costs.
- No sudden pressure changes

2. Pumped supply:

Used whenever The source of water is lower than the area to which we need to distribute water to (consumers). The source cannot maintain minimum pressure required.

Complicated operation and maintenance.

Dependent on reliable power supply.

Precautions have to be taken in order to enable permanent supply:

- Stock with spare parts
- Alternative source of power supply.

3. Combined Supply (pumped-storage supply): Both pumps and storage reservoirs are used.

This system is usually used in the following cases:

a) When two sources of water are used to supply water

b) In the pumped system sometimes a storage (elevated) tank is connectedto the system.

- When the water consumption is low, the residual water is pumped to the tank.

- When the consumption is high the water flows back to the consumer area by gravity

c) When the source is lower than the consumer area

- Then the water is pumped from the source to the storage (reservoir).

- And hence the water is distributed from the reservoir.

Distribution Systems (Network Configurations)

•In laying the pipes through the distribution area, the following configuration can be distinguished:

•Serial, Branching system (Tree), Grid system (Looped) and

Combined system

Design of Water Distribution Systems

A properly designed water distribution system should fulfill the following requirements:

Main requirements :

- Satisfied quality and quantity standards

Additional requirements:

- To enable reliable operation during irregular situations (power failure, fires..)

- To be economically and financially viable, ensuring income for operation, maintenance and extension.

- To be flexible with respect to the future extensions.

The design of water distribution systems must undergo through different studies and steps:

- Preliminary Studies
- Network Layout
- Hydraulic Analysis

Preliminary Studies:

Must be performed before starting the actual design:

Topographical Studies:

1. Contour lines (or controlling elevations).
2. Digital maps showing present (and future) houses, streets, lots, and so on.
3. Location of water sources so to help locating

Water Demand Studies:

It is defined as the amount of water drawn of within a certain period of time. It usually expressed as a flow in m^3 / h, l/s, or l/c/d.

Factors affecting water demand:

Climate - Size of the city - Habits of people - Cost of water - Quality of water - System of supply …… etc

Domestic demand It is the amount of water used for Drinking, Cocking, Gardening, Car Washing, Bathing, Laundry, Dish Washing, and Toilet Flushing.

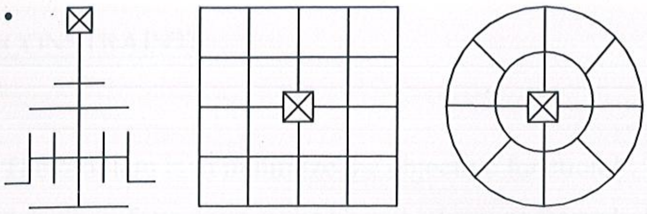
The average water consumption is different from one population to another. The average consumption may increase with the increase in standard of living. The water consumption varies hourly, daily, and monthly

Design Criteria

• The design criteria for water distribution system can be divided in non-hydraulic and hydraulic design consideration

•Are the design limitations required to get the most efficient and economical water-distribution network.

• One of the non-hydraulic criteria can be the ability to isolate part of the system especially during emergency operation. Hydraulic design criteria are primarily related to the flow and pressure in the network. Moreover, criteria for minimum and maximum pipe capacities, flow velocities, pressure fluctuations and pressure gradients are relevant factors.



(a) Branch network (b) Gridiron network (c) Ring and radial network

Chapter 2

GENERAL PRINCIPLES OF NETWORK SYNTHESIS

A pipe network should be designed in such a way to minimize its cost, keeping the aim
of supplying the fluid at requisite quantity and prescribed pressure head. The maximum
savings in cost are achieved by selecting proper geometry of the network. Usually, water distribution lines are laid along the streets of a city. Therefore, optimal design of a water
supply system should determine the pattern and the length of the street system in the city.

CONSTRAINTS

The problem is to minimize the objective function F. The objective function F is a function of decision variables (which are commonly known as design variables) like pipe diameters and pumping heads By selecting all the link diameters
and the input heads to zero, the objective function can be reduced to zero. This is not an acceptable situation as there will be no pipe network, and the objective of fluid transport will not be achieved. In order to exclude such a solution, additional conditions of transporting the fluid at requisite pressure head have to be prescribed.

Furthermore, restrictions of minimum diameter and maximum average velocity have to be observed. The restriction of minimum diameter is from practical considerations, whereas the restriction of maximum average velocity avoids excessive velocities that are injurious to the pipe material. These restrictions are called safety constraints. Additionally, certain relationships, like the summation of discharges at a nodal point should be zero, and so forth, have to be satisfied in a network. Such restrictions are called system constraints. These constraints are discussed in detail in the following sections.

ROUNDING OFF OF DESIGN VARIABLES

The calculated pipe diameter, pumping head, and the pumping horsepower are continuous in nature, thus can never be provided in actual practice as the pipe and the
pumping plant of The designer has to select a lower or higher size out of the commercially available pipe sizes than the calculated size. If a lower size is selected, the pipeline cost decreases at the expense of the pumping cost. On the other hand, if the higher size is selected, the pumping cost decreases at the expense of the pipeline cost. Out of these two options, one is more economical than the other. For a pumping main, both the options are evaluated, and the least-cost solution can be adopted.

As the available pumping horsepower varies in certain increments, one may select the pumping plant of higher horsepower. However, it is notrequired to revise pipe diameter also as the cost of the pumping plant is insignificant in comparison with the pumping cost or the power cost. Similarly, if the number of pumping stages in a multi-stage pumping main involves a fractional part, the next higher number should be adopted for the pumping stages. Requisite sizes and specifications are not manufactured commercially.

ESSENTIAL PARAMETERS FOR NETWORK SIZING

The selection of the design period of a water supply system, projection of water demand, per capita rate of water consumption, design peak factors, minimum prescribed pressure head in distribution system, maximum allowable pressure head, minimum and maximum pipe sizes, and reliability considerations are some of the important parameters required to be selected

Water Demand

The estimation of water demand for the sizing of any water supply system or its component is the most important part of the design methodology. In general, water demands are generated from residential, industrial, and commercial developments, community facilities, firefighting demand, and account for system losses. It is difficult to predict water demand accurately as a number of factors affect the water demand (i.e., climate, economic and social factors, pricing, land use, and industrialization of the area). However, a comprehensive study should be conducted to estimate water demand considering all the site-specific factors. The residential forecast of future demand can be based on house count, census records, and population projections.

Rate of Water Supply

To estimate residential water demand, it is important to know the amount of water consumed per person per day for in-house (kitchen, bathing, toilet, and laundry) usage and external usage for garden irrigation. The average daily per capita water consumption variations depend upon a number of factors.

per capita water usage varies widely due to the differences in (1) climatic conditions, (2) standard of living, (3) extent of sewer

system, (4) type of commercial and industrial activity, (5) water pricing, (6) resort to private supplies, (7) water quality for domestic and industrial purposes, (8) distribution system pressure, (9) completeness of meterage, and (10) system management.

before designing any water system.

Peak Factor

The water demand is not constant throughout the day and varies greatly over the day. Generally, the demand is lowest during the night and highest during morning or evening hours of the day. The ratio of peak hourly demand to average hourly demand is defined as peak factor.

Minimum Pressure Requirements

The minimum design nodal pressures are prescribed to discharge design flows onto the properties. Generally, it is based on population served, types of dwellings in the area, and firefighting requirements.

Minimum Size of Distribution Main

The minimum size of pipes in a water distribution system is specified to ensure adequate flow rates and terminal pressures. It works as factor of safety against assumed population load on a pipe link and also provides a guarantee to basic firefighting capability. The minimum pipe sizes are normally specified based on total population of a city. .

Maximum Size of Water Distribution

The maximum size of a distribution main depends upon the commercially available pipe sizes for different pipe material, which can be obtained from local manufacturers. .

Reliability Considerations

Generally, water distribution systems are designed for optimal configuration that could satisfy minimum nodal pressure criteria at required flows. The reliability considerations are rarely included in such designs. The reliability of water supply system can be divided into structural and functional forms. The structural reliability is associated with pipe, pump, and other system components probability of failure, and the functional reliability is associated with meeting nodal pressure and flow requirements

Design Period of Water Supply Systems

Water supply systems are planned for a pre-decided time horizon generally called design period. In current design practices, disregarding the increase in water demand, the life of pipes, and future discount rate, the design period is generally adopted as 30 years on an ad hoc basis.

Pipe Material and Class Selection

Commercial pipes are manufactured in various pipe materials; for example, poly (vinyl chloride) (PVC), unplasticised PVC (uPVC), polyethylene (PE), asbestos cement (AC), high-density polyethylene (HDPE), mild steel (MS), galvanized iron (GI) and electric resistance welded (ERW). These pipes have different roughness heights, working pressure, and cost. The distribution system can be designed initially for any pipe material on an ad hoc basis, say CI, and then economic pipe material for each pipe link of the system can be selected. Such a pipe material selection should be based on maximum water pressure on pipes and their sizes, considering the entire range of commercial pipes, their materials, working pressures, and cost.

Velocity

- Not be lower than 0.3 m/s to prevent sedimentation
- Not be more than 2 m/s to prevent erosion and high head losses.
- Commonly used values are 1 - 1.5 m/sec.

Pressure

Municipal distribution systems ranges from 150-300 kPa in residential districts with structures of four stories or less and 400-500 kPa in commercial districts.

•Also, for fire hydrants the pressure should not be less than 150 kPa (15 m of water).

•In general for any node in the network the pressure should not be less than 15 m of water.

•Moreover, the maximum pressure should be limited to 75 m of water

General requirement for pipe network

1. Mains should be divided into sections and valves should be provided so that any section may be taken out of operation for repair.
2. Dead ends are to be avoided. If a dead-end is must, a hydrant should be provided for cleaning.
3. Air valves at summits and drains at the lowest point between summits should be installed.
4. Mains should follow the general contour of the ground.
5. Pipe should not rise above the hydraulic gradient.
6. The minimum cover under roadway should be 90cm and under paths 75 cm.
7. Proper installation and operation of water supply system requires that a number of appurtenances be provided in the pipeline;
8. Gate valve: they are used at summits and to isolate a particular section.
9. Sluice gate: They are used in pipelines laid at steep grades or in openings into wells .
10. Check valves: (non return valve): to allow flow in one direction only.
11. Pipes constructed of steel and other flexible material must have valves that automatically allow air to enter when the pipeline is emptied in order to prevent a vacuum, which will cause the pipe to collapse.

Chapter 3

Water distribution system simulation

• A network simulation implies the calculation of all the network pressure heads and flows together with reservoir levels, and for known pump and valve controls and consumer demands.

• Network simulations, which replicate the dynamics of an existing or proposed system, are commonly performed in the following situations:

1. When it is not practical for the real system to be directly subjected to experimentation, or for the purpose of evaluating a system before it is actually built.
2. To predict system response to events under a wide range of conditions without disrupting the actual system.
3. To anticipate problems in an existing or proposed system and solutions can be evaluated before time, money and materials are invested.

Types of simulation

Steady State Simulation: It represents a snapshot in time and are used to determine the operating behavior under static conditions. This type of analysis can be useful in determination of the short-term effect of fir flows on the

system or the size of pipes in the network for the water demand required.

Extended Period Simulation (EPS): It is used to evaluate system performance overtime. This allows the user to check if the used design criteria is satisfied (Pressure, Velocity) throughout the system in response to varying demand conditions, model the tank filling and draining and regulate valves opening and closing.

Assembling a model

1. Reservoirs:

A reservoir represents a boundary node in a model that can supply or accept water with such a large capacity that the hydraulic grade of the reservoir is unaffected and remains constant. It is an infinite source, which means that it can theoretically handle any inflow or outflow rate for any period of time, without running dry or overflowing. In reality, there is no such thing as a true infinite source. For modeling purpose however, there are situations where inflows and outflows have little or no effect at all on the hydraulic grade at a node. Reservoirs are used to model any source of water where the hydraulic grade is controlled by factors other than the water usage rate. Lakes, groundwater wells and clear wells at water treatment plants are often represented as reservoirs in water distribution system models. For a reservoir, the two pieces of information required are the hydraulic grade (Water Surface Level) and the water quality.

2. Tanks:

A storage tank is also a boundary node, but unlike the reservoir, the hydraulic grade line of the tank fluctuates according to the inflow and the outflow of water. Tanks have a finite storage volume, and it is possible to completely fill or completely exhaust that storage. Storage tanks are present in most real-world distribution systems, and the relation between a tank and its model counterpart is typically forward. For steady-state runs, the tank is viewed as a known hydraulic grade elevation, and the model calculates how fast water is flowing into or out of the tank. In Extended Period Simulation (EPS) models, the water level in the tank is allowed to vary over time.

3. Junctions:

At the term implies, one of the primary uses of a junction node is to provide a location for two or more pipes to meet. Junctions, however, do not need to be elemental intersections, as a junction may exist in an end of a single pipe (Typically referred to as a dead-end). The major role of a junction is to provide a location to withdraw water demanded from the system or inject the inflows into the system. Junction nodes typically do not directly relate to real-world distribution system components, since pipes are usually joined with fittings and flow are extracted from the system at any number of customer connections along the pipe. Most water users have such small individual impact that their water withdrawal can be assigned as a sum to nearby nodes without adversely affecting the model

What is WaterCad?

Water-CAD is a program used to build and analyze the water distribution network.

- Stand-Alone, Micro-station and AutoCAD environments
- Quick model building from any data source
- Easy-to-use layout and editing tools
- Unrivaled hydraulic analysis features
- Stunning result presentation tools

WaterCAD Features

- Steady-State Analysis
- Extended-Period Simulation (EPS)
- Constituent-Concentration Analysis
- Source Tracing
- Criticality Analysis
- Tank-Mixing Analysis
- Water-Age Analysis
- Fire-Flow Analysis
- Variable-Speed Pumping
- Pressure-Dependent Demands
- Scenario Modeling-Based Unidirectional Flushing

Procedures

1. Layout the network and input required data for every component.
2. Analysis.
3. Browse the results of analysis.

Network Elements

- Nodes.
- Pipes.
- Valves
- Tanks.
- Reservoirs.
- Pumps.

Pumps

- Are modeled as constant water level sources
- Can supply any demand.

Tanks

- Obey conservation of mass
- Have a finite size
- Water level moves up and down and thus pressures in system change.

- Need to define tank geometry

Pumps

- Require a Pump Curve (discharge vs. head)
- Initial setting
- Controls for extended time analysis

Water Distribution System

- Reservoir - used to model a clear well.
- Pump to lift water to elevated storage tank.
- Turns on and off based on water level in tank.
- Tank feeds distribution grid.
- Demands applied at junctions.

Equations used by WaterCad

•The friction can be calculated by:

1. Darcy-Weisbach.
2. Hazen-Williams.
3. Mannings.

Scenarios Management

- Calculate multiple "What if" situations
- Alternatives
- Parent child relationship

Reporting Results

- Reports
- Tabular Reports w/ Flex Tables
- Profiles
- Contouring
- Thematic Mapping
- Property-Based Annotation
- Property-Based Color Coding and Symbology

Chapter 4

DETAIL OF PROJECT AREA

Name of work

Detailed project report for LWSS Karara from river Beas in tehsil and Distt Hamirpur

Census population in 2000 = 5433

Present population as on 2010 = 7135

Name of scheme = lift

General information

Geography

Hamirpur District is situated between 76°18' and 76° 44' east longitudes and between 31°25' and 31° 52' north latitudes. Situated at an altitude of 785 meters, Hamirpur is the disst headquarters

Climate

It is not a typical "Hilly & Chilly" type of climate in district Hamirpur as it is more closer to plains. During winter, the climate is cold but pleasant .During summer the temperature is hot .Average annual rainfall is 1000mm

Purpose of project

To provide adequate water supply for domestic and irrigation purposes to karara region

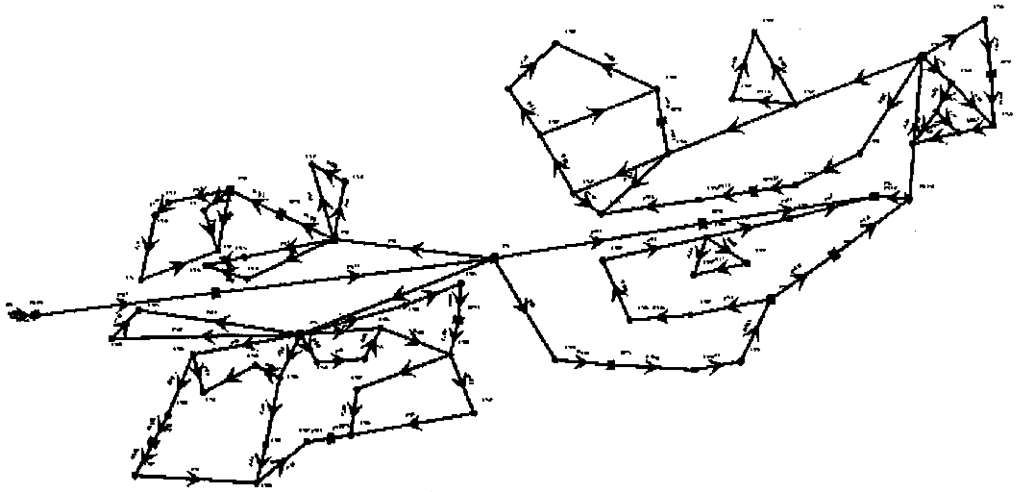
Need of project

The population for which the system has been designed has increased considerably. Added with the fact that for these new integrated area in the system, no service reservoir is reservoirs were added. This has lead to inadequate pressure in some parts of the system.

Scope of project

Detailed design of the distribution system , ensuring equitable distribution of water and adequate residual head of minimum of 15m at all drawal points incorporating existing pipes that can be used . The storage tank shall be interlinked in a grid system as far as possible.

STEADY STATE ANALYSIS



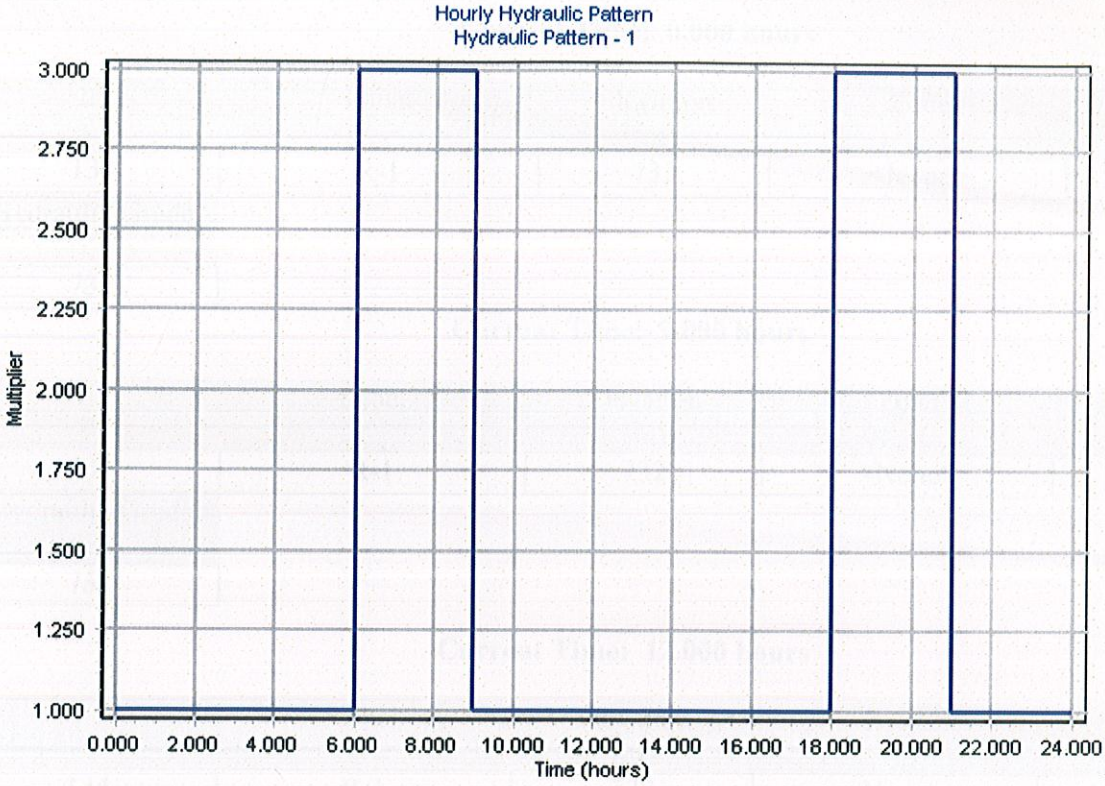
LAYOUT OF DISTRIBUTION NETWORK 1

Calculation Summary (1: Base)

Time (hours)	Balanced?	Trials	Relative Flow Change	Flow Supplied (L/d)
All Time Steps(0)	TRUE	7	0.0000701	1250540.11
0.000	TRUE	7	0.0000701	1250540.11

Flow Demanded (L/d)	Flow Stored (L/d)
748319.88	502142.12
748319.88	502142.12

EXTENDED PERIOD SIMULATION



Pattern Detailed Report: Hydraulic Pattern - 1.

Element Details

ID	139	Notes	
Label	Hydraulic Pattern - 1		

<Pattern Summary>

Start Time	12:00:00 AM	Pattern Category Type	Hydraulic
Starting Multiplier	1.000	Stepwise	

Pattern Curve

Time from Start (hours)	Multiplier
3	1
6	3
9	1
18	3
21	1
24	1

FlexTable: Reservoir Table (FINAL PROJECT.wtg)

Current Time: 0.000 hours

ID	Label	Elevation (m)	Zone	Net Outflow (L/d)	Hydraulic Grade (m)
134	R-1	732	<None>	1250540.11	732

Current Time: 9.000 hours

ID	Label	Elevation (m)	Zone	Net Outflow (L/d)	Hydraulic Grade (m)
134	R-1	732	<None>	1386552.02	732

Current Time: 12.000 hours

ID	Label	Elevation (m)	Zone	Net Outflow (L/d)	Hydraulic Grade (m)
134	R-1	732	<None>	1399833.07	732

Current Time: 21.000 hours

ID	Label	Elevation (m)	Zone	Net Outflow (L/d)	Hydraulic Grade (m)
134	R-1	732	<None>	1436184.28	732

Current Time: 24.000 hours

ID	Label	Elevation (m)	Zone	Net Outflow (L/d)	Hydraulic Grade (m)
134	R-1	732	<None>	1445647.83	732

FlexTable: Tank Table (FINAL PROJECT.wtg)

Current Time: 0.000 hours

ID	Label	Zone	Elevation (Base) (m)	Elevation (Minimum) (m)	Elevation (Initial) (m)	Elevation (Maximum) (m)	Volume (Inactive) (ML)	Diameter (m)	Net Outflow (L/d)	Hydraulic Grade (m)
25	T-1	<None>	920	923	933	940	0	25	23996604.73	933
27	T-2	<None>	885	888	892	898	0	10	267305.31	892
29	T-3	<None>	870	873	878	882	0	5	-2263875.35	878
78	T-4	<None>	895	898	905	908	0	5	-2342160.68	905
140	T-5	<None>	901	905	910	930	0	12	-38443950.7	910
144	T-6	<None>	1016.2	1018	1025	1033	0	5	-801053.1	1025
148	T-7	<None>	910	915	925	930	0	8	19084995.19	925

Current Time: 9.000 hours

ID	Label	Zone	Elevation (Base) (m)	Elevation (Minimum) (m)	Elevation (Initial) (m)	Elevation (Maximum) (m)	Volume (Inactive) (ML)	Diameter (m)	Net Outflow (L/d)	Hydraulic Grade (m)
25	T-1	<None>	920	923	933	940	0	25	2763901.99	926.6841
27	T-2	<None>	885	888	892	898	0	10	-1775132.64	896.0607
29	T-3	<None>	870	873	878	882	0	5	95638.87	882
78	T-4	<None>	895	898	905	908	0	5	-1859019.35	908
140	T-5	<None>	901	905	910	930	0	12	1574203.13	927.5522
144	T-6	<None>	1016.2	1018	1025	1033	0	5	-837599.77	1031.6786
148	T-7	<None>	910	915	925	930	0	8	-596050.11	920.681

Current Time: 21.000 hours

ID	Label	Zone	Elevation (Base) (m)	Elevation (Minimum) (m)	Elevation (Initial) (m)	Elevation (Maximum) (m)	Volume (Inactive) (ML)	Diameter (m)	Net Outflow (L/d)	Hydraulic Grade (m)
25	T-1	<None>	920	923	933	940	0	25	2019430.06	924.0746
27	T-2	<None>	885	888	892	898	0	10	-1593400.22	896.7308
29	T-3	<None>	870	873	878	882	0	5	95638.82	882
78	T-4	<None>	895	898	905	908	0	5	-1630027.74	908
140	T-5	<None>	901	905	910	930	0	12	1153974.12	924.8535
144	T-6	<None>	1016.2	1018	1025	1033	0	5	-814967.87	1031.9282
148	T-7	<None>	910	915	925	930	0	8	82217.99	924.8005

Current Time: 24.000 hours

ID	Label	Zone	Elevation (Base) (m)	Elevation (Minimum) (m)	Elevation (Initial) (m)	Elevation (Maximum) (m)	Volume (Inactive) (ML)	Diameter (m)	Net Outflow (L/d)	Hydraulic Grade (m)
25	T-1	<None>	920	923	933	940	0	25	1944739.41	923.5718
27	T-2	<None>	885	888	892	898	0	10	-1558612.87	897.2694
29	T-3	<None>	870	873	878	882	0	5	95638.77	882
78	T-4	<None>	895	898	905	908	0	5	-1600253.05	908
140	T-5	<None>	901	905	910	930	0	12	1075466.63	924.2299
144	T-6	<None>	1016.2	1018	1025	1033	0	5	-807429.51	1032.2778
148	T-7	<None>	910	915	925	930	0	8	153143.15	924.4192

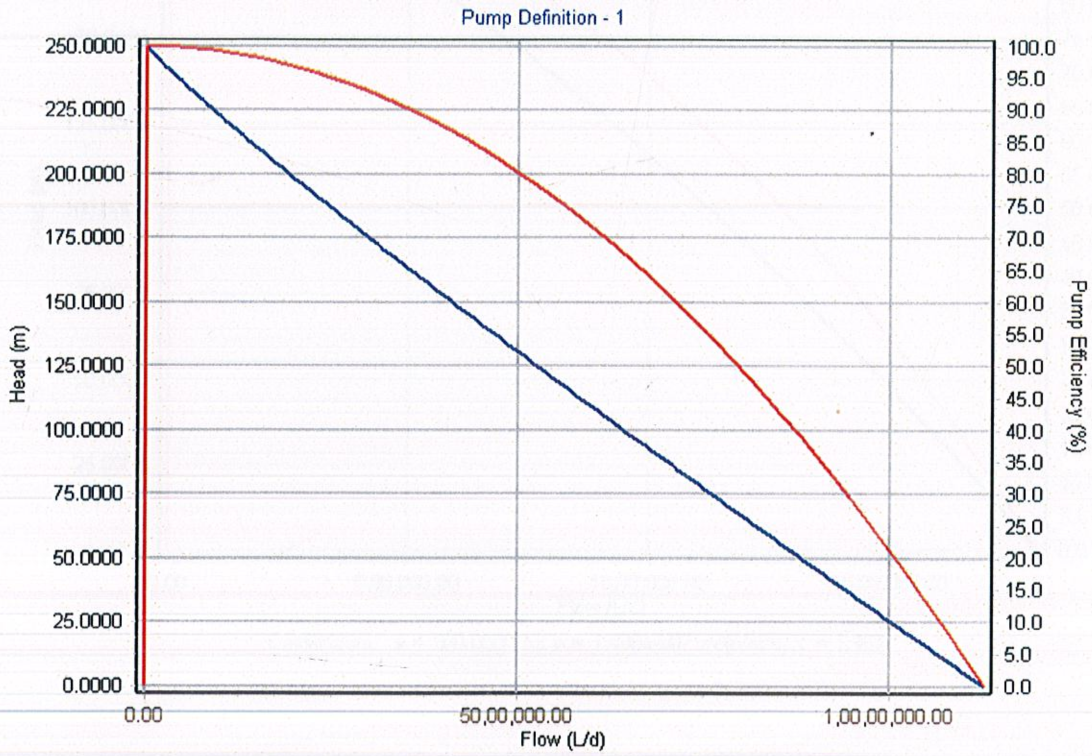
Pump Definition Detailed Report: Pump Definition - 1

Element Details

ID	133	Notes	
Label	Pump Definition - 1		

Pump Definition Type

Pump Definition Type	Standard (3 Point)	Design Head	230	m
Shutoff Flow	0.00	L/d	1500000	L/d
Shutoff Head	250.0000	m	210	m
Design Flow	7,00,000.00	L/d		



Coefficients: a = 250.0000 m; b = 9.662e-005 m/(L/d)^c; c = 0.909

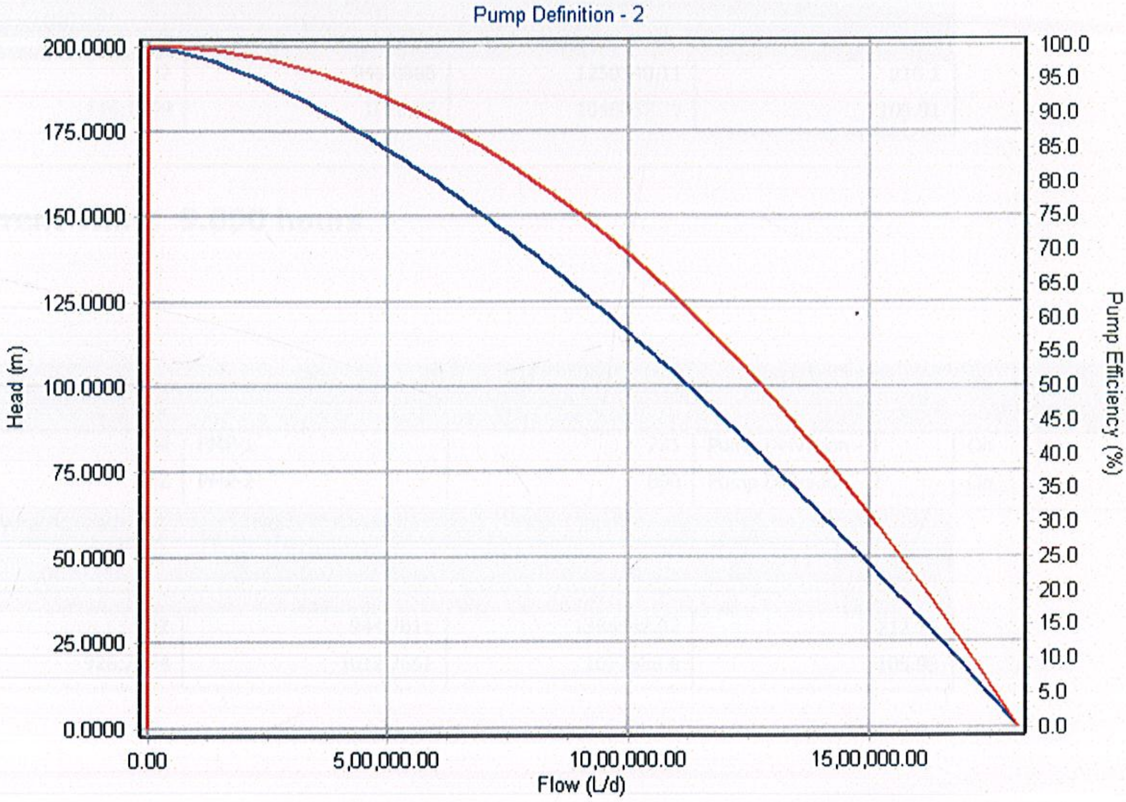
Pump Definition Detailed Report: Pump Definition - 2

Element Details

ID	233	Notes	
Label	Pump Definition - 2		

Pump Definition Type

Pump Definition Type	Standard (3 Point)		Design Head	150	m
Shutoff Flow	0.00	L/d		1200000	L/d
Shutoff Head	200.0000	m		90	m
Design Flow	7,00,000.00	L/d			



Coefficients: a = 200.0000 m; b = 1.408e-007 m/(L/d)^c; c = 1.463

FlexTable: Pump Table (FINAL PROJECT.wtg)

Current Time: 0.000 hours

ID	Label	Elevation (m)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (m)	Hydraulic Grade (Discharge) (m)	Flow (Total) (L/d)	Pump Head (m)
24	PMP-1	731	Pump Definition - 1	On	732	948.0986	1250540.11	216.1
142	PMP-2	890	Pump Definition - 2	On	916.1359	1026.05	1046857.32	109.91

Current Time: 9.000 hours

ID	Label	Elevation (m)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (m)	Hydraulic Grade (Discharge) (m)	Flow (Total) (L/d)	Pump Head (m)
24	PMP-1	731	Pump Definition - 1	On	732	944.7611	1386552.02	212.76
142	PMP-2	890	Pump Definition - 2	On	926.7774	1032.7651	1077838.8	105.99

Current Time: 21.000 hours

ID	Label	Elevation (m)	Pump Definition	Status (Initial)
24	PMP-1	731	Pump Definition - 1	On
142	PMP-2	890	Pump Definition - 2	On

Hydraulic Grade (Suction) (m)	Hydraulic Grade (Discharge) (m)	Flow (Total) (L/d)	Pump Head (m)
732	943.5507	1436184.45	211.55
924.8218	1032.7631	1062475.94	107.94

Current Time: 24.000 hours

ID	Label	Elevation (m)	Pump Definition	Status (Initial)
24	PMP-1	731	Pump Definition - 1	On
142	PMP-2	890	Pump Definition - 2	On

Hydraulic Grade (Suction) (m)	Hydraulic Grade (Discharge) (m)	Flow (Total) (L/d)	Pump Head (m)
732	943.3204	1445647.83	211.32
924.2211	1033.3396	1053169.68	109.12

FlexTable: Pipe Table (FINAL PROJECT.wtg)

Current Time: 0.000 hours

	Start Node	Stop Node	Flow L/d	Velocity m/s	Headloss gradient m/m	Material
P-2	T-1	T-2	2175263.61	1.38	0.014	Ductile Iron
P-4	T-3	J-1	30867	0.17	0.001	Ductile Iron
P-8	J-1	J-7	6866.99	0.04	0.001	Ductile Iron
P-9	J-7	J-8	-3947.21	0.02	0.007	Ductile Iron
P-12	T-3	J-11	37427.21	0.2	0.001	Ductile Iron
P-13	J-11	J-12	17507.21	0.09	0.002	Ductile Iron
P-14	J-12	J-8	9347.21	0.05	0.003	Ductile Iron
P-16	T-2	J-13	31620.77	0.08	0.001	Ductile

						Iron
P-17	T-2	J-14	17339.23	0.09	0.002	Ductile Iron
P-18	J-14	J-15	2459.23	0.01	0.005	Ductile Iron
P-19	J-15	J-13	-18540.77	0.1	0.001	Ductile Iron
P-20	T-2	J-16	15943.47	0.09	0.011	Ductile Iron
P-21	T-2	J-17	18136.53	0.1	0.001	Ductile Iron
P-22	J-17	J-16	-5143.47	0.03	0.007	Ductile Iron
P-29	T-1	T-4	2462176.35	1.56	0.017	Ductile Iron
P-30	T-4	J-23	15976.62	0.09	0.003	Ductile Iron
P-31	T-4	J-24	15583.38	0.08	0.004	Ductile Iron
P-32	J-24	J-23	-5776.62	0.03	0.002	Ductile Iron
P-33	T-4	J-25	20671.12	0.11	0.001	Ductile Iron
P-34	J-25	J-26	15437.52	0.08	0.001	Ductile Iron
P-36	T-4	J-28	38147.78	0.2	0.001	Ductile Iron
P-40	J-31	J-32	11581.38	0.16	0.002	Ductile Iron
P-41	J-27	J-32	9898.57	0.23	0.004	Ductile Iron
P-42	T-4	J-33	9485.19	0.22	0.004	Ductile Iron

P-43	J-33	J-34	7445.19	0.17	0.002	Ductile Iron
P-44	T-4	J-35	13187.94	0.3	0.007	Ductile Iron
P-45	J-35	J-36	14991.54	0.34	0.008	Ductile Iron
P-47	J-36	J-37	6614.18	0.15	0.002	Ductile Iron
P-48	J-37	J-38	2414.18	0.06	0.006	Ductile Iron
P-49	J-32	J-39	15719.95	0.36	0.009	Ductile Iron
P-51	J-36	J-40	7185.88	0.16	0.002	Ductile Iron
P-52	J-40	J-38	1785.87	0.04	0.009	Ductile Iron
P-53	J-25	J-41	1633.6	0.01	0.004	Ductile Iron
P-54	J-41	J-42	-3166.4	0.02	0.002	Ductile Iron
P-55	J-42	J-28	-6766.4	0.06	0.003	Ductile Iron
P-56	T-4	J-43	6963.6	0.16	0.002	Ductile Iron
P-57	J-43	J-44	4203.6	0.1	0.001	Ductile Iron
P-58	J-44	J-35	3003.6	0.07	0.001	Ductile Iron
P-60	R-1	PMP-1	1250540.11	0.45	0.002	Ductile Iron
P-61	T-3	J-7	27345.79	0.15	0.001	Ductile Iron
P-62	J-28	J-31	18181.38	0.42	0.012	Ductile

						Iron
P-65	PMP-2	T-6	1046857.32	1.54	0.027	Ductile Iron
P-66	T-6	J-45	21708.78	0.13	0.001	Ductile Iron
P-74	T-6	J-52	68670.81	0.04	0.005	Ductile Iron
P-75	J-52	J-53	24827.06	0.15	0.001	Ductile Iron
P-76	J-52	J-54	34243.75	0.2	0.001	Ductile Iron
P-77	J-54	J-55	7017.03	0.04	0.006	Ductile Iron
P-78	J-54	J-56	10426.72	0.06	0.004	Ductile Iron
P-79	T-6	J-57	97079.66	0.06	0.001	Ductile Iron
P-80	J-57	J-58	67079.65	0.4	0.005	Ductile Iron
P-81	J-58	J-59	60774.72	0.04	0.005	Ductile Iron
P-82	J-59	J-60	40205.78	0.24	0.002	Ductile Iron
P-83	J-60	J-61	10579.6	0.06	0.007	Ductile Iron
P-84	J-61	J-62	10579.6	0.06	0.003	Ductile Iron
P-85	J-60	J-63	20026.17	0.01	0.001	Ductile Iron
P-86	J-58	J-64	6293.06	0.04	0.002	Ductile Iron
P-87	T-5	J-65	-559755.83	0.82	0.009	Ductile Iron

P-88	J-65	J-66	-569955.86	0.84	0.009	Ductile Iron
P-89	J-66	J-67	-614355.84	3.62	0.297	Ductile Iron
P-90	J-67	J-68	-673155.88	3.97	0.351	Ductile Iron
P-91	T-7	J-69	700395.79	0.26	0.011	Ductile Iron
P-92	J-66	J-70	12978.93	0.08	0.009	Ductile Iron
P-93	J-66	J-71	21821.06	0.13	0.001	Ductile Iron
P-95	T-1	J-73	357536.1	2.11	0.109	Ductile Iron
P-97	J-74	J-75	306309.11	1.81	0.082	Ductile Iron
P-98	T-6	J-76	58345.01	0.34	0.004	Ductile Iron
P-99	J-76	J-77	39145.01	0.23	0.002	Ductile Iron
P-102	J-56	J-55	-7573.28	0.04	0.006	Ductile Iron
P-103	J-55	J-53	-5116.26	0.03	0.002	Ductile Iron
P-105	J-62	J-63	-11020.4	0.06	0.001	Ductile Iron
P-107	J-59	J-64	8568.94	0.05	0.003	Ductile Iron
P-108	J-68	J-69	-689595.86	0.25	0.001	Ductile Iron
P-110	J-71	J-70	-12978.93	0.08	0.008	Ductile Iron
P-111	J-75	T-7	294309.1	0.43	0.003	Ductile

						Iron
P-112	J-64	J-78	-11538	0.07	0.004	Ductile Iron
P-113	J-57	J-79	15338.84	0.09	0.034	Ductile Iron
P-114	J-57	J-80	14661.16	0.09	0.006	Ductile Iron
P-115	J-80	J-79	8661.16	0.05	0.005	Ductile Iron
P-119	T-5	PMP-2	- 17632047.38	11.19	0.652	Ductile Iron
P-136	PMP-1	CV-1	1250540.11	0.45	0.001	Ductile Iron
P-137	CV-1	T-1	1250545.52	0.45	0.001	Ductile Iron
P-138	T-1	CV-2	20252170.44	7.46	0.224	Ductile Iron
P-139	CV-2	T-5	20252147.82	7.46	0.224	Ductile Iron
P-140	T-2	CV-3	2359528.9	1.5	0.016	Ductile Iron
P-141	CV-3	T-3	2359515.26	1.5	0.016	Ductile Iron
P-142	J-73	CV-4	329096.11	1.94	0.093	Ductile Iron
P-143	CV-4	J-74	329109.09	1.94	0.093	Ductile Iron
P-144	T-7	CV-5	18678908.19	6.88	0.193	Ductile Iron
P-145	CV-5	PMP-2	18678904.2	6.88	0.193	Ductile Iron
P-146	J-63	CV-6	0	0	0.017	Ductile Iron

P-147	CV-6	J-58	0	0	0.005	Ductile Iron
P-148	J-45	CV-7	4308.78	0.03	0.002	Ductile Iron
P-149	CV-7	J-53	4289.2	0.03	0.001	Ductile Iron
P-150	J-39	CV-8	-0.05	0	0.004	Ductile Iron
P-151	CV-8	J-38	-0.05	0	0.003	Ductile Iron
P-152	J-26	CV-9	11837.52	0.06	0.007	Ductile Iron
P-153	CV-9	J-27	11818.57	0.06	0.003	Ductile Iron
P-154	J-77	CV-10	27745.01	0.16	0.001	Ductile Iron
P-155	CV-10	J-78	27738	0.16	0.001	Ductile Iron
P-156	J-34	CV-11	5645.19	0.13	0.001	Ductile Iron
P-157	CV-11	J-36	5648.51	0.13	0.001	Ductile Iron

Current Time: 9.000 hours Label	Diameter (mm)	Flow (L/d)	Velocity (m/s)	Headloss Gradient (m/m)	Start Node	Stop Node
P-2	150	1858159.31	1.18	0.01	T-1	T-2
P-4	52.4	30867	0.17	0.001	T-3	J-1
P-8	52.4	6867	0.04	0.006	J-1	J-7

P-9	52.4	-3947.21	0.02	0.004	J-7	J-8
P-12	52.4	37427.21	0.2	0.001	T-3	J-11
P-13	52.4	17507.21	0.09	0.002	J-11	J-12
P-14	52.4	9347.21	0.05	0.002	J-12	J-8
P-16	75	31620.77	0.08	0.001	T-2	J-13
P-17	52.4	17339.23	0.09	0.003	T-2	J-14
P-18	52.4	2459.22	0.01	0.004	J-14	J-15
P-19	52.4	-18540.77	0.1	0.003	J-15	J-13
P-20	52.4	15943.47	0.09	0.002	T-2	J-16
P-21	52.4	18136.53	0.1	0.001	T-2	J-17
P-22	52.4	-5143.47	0.03	0.001	J-17	J-16
P-29	150	1979045.66	1.26	0.011	T-1	T-4
P-30	52.4	15976.62	0.09	0.001	T-4	J-23
P-31	52.4	15583.38	0.08	0.005	T-4	J-24
P-32	52.4	-5776.62	0.03	0.001	J-24	J-23
P-33	52.4	20669.43	0.11	0.002	T-4	J-25
P-34	52.4	15433.71	0.08	0.003	J-25	J-26
P-36	52.4	38145.61	0.2	0.001	T-4	J-28
P-40	32.4	11581.33	0.16	0.002	J-31	J-32
P-41	25.4	9898.62	0.23	0.004	J-27	J-32
P-42	25.4	9492.35	0.22	0.004	T-4	J-33
P-43	25.4	7452.35	0.17	0.002	J-33	J-34
P-44	25.4	13193.33	0.3	0.007	T-4	J-35
P-45	25.4	14998.96	0.34	0.008	J-35	J-36
P-47	25.4	6614.18	0.15	0.002	J-36	J-37
P-48	25.4	2414.18	0.06	0.001	J-37	J-38

P-49	25.4	15719.95	0.36	0.009	J-32	J-39
P-51	25.4	7185.88	0.16	0.002	J-36	J-40
P-52	25.4	1785.87	0.04	0.002	J-40	J-38
P-53	52.4	1635.72	0.01	0.001	J-25	J-41
P-54	52.4	-3164.28	0.02	0.007	J-41	J-42
P-55	42.4	-6764.28	0.06	0.005	J-42	J-28
P-56	25.4	6965.63	0.16	0.002	T-4	J-43
P-57	25.4	4205.63	0.1	0.001	J-43	J-44
P-58	25.4	3005.63	0.07	0.001	J-44	J-35
P-60	202.4	1382399.73	0.5	0.023	R-1	PMP-1
P-61	52.4	27345.79	0.15	0.001	T-3	J-7
P-62	25.4	18181.33	0.42	0.012	J-28	J-31
P-65	100	1083375.55	1.6	0.029	PMP-2	T-6
P-66	50	21693.92	0.13	0.001	T-6	J-45
P-74	152.4	68643.57	0.04	0.001	T-6	J-52
P-75	50	24813.44	0.15	0.001	J-52	J-53
P-76	50	34230.13	0.2	0.001	J-52	J-54
P-77	50	7006.42	0.04	0.002	J-54	J-55
P-78	50	10423.71	0.06	0.015	J-54	J-56
P-79	152.4	97088.23	0.06	0.004	T-6	J-57
P-80	50	67088.24	0.4	0.005	J-57	J-58
P-81	152.4	60782.9	0.04	0.002	J-58	J-59
P-82	50	40218.54	0.24	0.002	J-59	J-60
P-83	50	10579.65	0.06	0.001	J-60	J-61
P-84	50	10579.65	0.06	0.001	J-61	J-62
P-85	152.4	20038.88	0.01	0.003	J-60	J-63

P-86	50	6291.08	0.04	0.001	J-58	J-64
P-87	100	490862.48	0.72	0.007	T-5	J-65
P-88	100	480662.49	0.71	0.006	J-65	J-66
P-89	50	436262.47	2.57	0.157	J-66	J-67
P-90	50	377462.47	2.23	0.12	J-67	J-68
P-91	200	-350222.48	0.13	0.009	T-7	J-69
P-92	50	12978.93	0.08	0.012	J-66	J-70
P-93	50	21821.06	0.13	0.001	J-66	J-71
P-95	50	309077.94	1.82	0.083	T-1	J-73
P-97	50	257827.62	1.52	0.059	J-74	J-75
P-98	50	58350.02	0.34	0.004	T-6	J-76
P-99	50	39150.01	0.23	0.002	J-76	J-77
P-102	50	-7576.29	0.04	0.009	J-56	J-55
P-103	50	-5129.87	0.03	0.001	J-55	J-53
P-105	50	-11020.35	0.06	0.001	J-62	J-63
P-107	50	8564.36	0.05	0.004	J-59	J-64
P-108	200	361022.49	0.13	0.003	J-68	J-69
P-110	50	-12978.93	0.08	0.006	J-71	J-70
P-111	100	245827.61	0.36	0.002	J-75	T-7
P-112	50	-11544.56	0.07	0.005	J-64	J-78
P-113	50	15338.84	0.09	0.001	J-57	J-79
P-114	50	14661.16	0.09	0.002	J-57	J-80
P-115	50	8661.16	0.05	0.008	J-80	J-79
P-119	200	1083340.61	0.69	0.004	T-5	PMP-2
P-136	202.4	1382399.73	0.5	0.001	PMP-1	CV-1
P-137	202.4	1382381.1	0.5	0.001	CV-1	T-1

P-138	200	0	0	0.002	T-1	CV-2
P-139	200	0	0	0.003	CV-2	T-5
P-140	152.4	-13.45	0	0.001	T-2	CV-3
P-141	152.4	0	0	0.005	CV-3	T-3
P-142	50	280637.93	1.65	0.069	J-73	CV-4
P-143	50	280627.62	1.65	0.069	CV-4	J-74
P-144	200	-0.01	0	0.001	T-7	CV-5
P-145	200	-0.27	0	0.002	CV-5	PMP-2
P-146	50	11.13	0	0.001	J-63	CV-6
P-147	50	11.13	0	0.005	CV-6	J-58
P-148	50	4293.92	0.03	0.001	J-45	CV-7
P-149	50	4316.43	0.03	0.003	CV-7	J-53
P-150	25.4	-0.05	0	0.004	J-39	CV-8
P-151	25.4	-0.05	0	0.005	CV-8	J-38
P-152	52.4	11833.71	0.06	0.001	J-26	CV-9
P-153	52.4	11818.62	0.06	0.002	CV-9	J-27
P-154	50	27750.02	0.16	0.001	J-77	CV-10
P-155	50	27744.55	0.16	0.001	CV-10	J-78
P-156	25.4	5652.35	0.13	0.001	J-34	CV-11
P-157	25.4	5641.09	0.13	0.001	CV-11	J-36

FlexTable: Junction Table (FINAL PROJECT.wtg)

Current Time: 0.000 hours

Label	Elevation (m)	Demand (L/d)	Hydraulic Grade (m)	Pressure (kPa)	Pressure Head (m)
J-1	853	24000	877.2859	237.7	24.29

J-7	859.7	38160	877.259	171.8	17.56
J-8	856.7	5400	877.2744	201.4	20.57
J-11	852.65	19920	877.3904	242.1	24.74
J-12	851.5	8160	877.3352	252.8	25.84
J-13	876	13080	891.7971	154.6	15.8
J-14	874	14880	891.6175	172.4	17.62
J-15	872.6	21000	891.6167	186.1	19.02
J-16	873	10800	891.9318	185.3	18.93
J-17	871	23280	891.9273	204.8	20.93
J-23	870	10200	904.7289	339.9	34.73
J-24	868	21360	904.7071	359.2	36.71
J-25	878	3600	904.7352	261.7	26.74
J-26	876	3600	904.6812	280.7	28.68
J-27	874	1920	904.6577	300	30.66
J-28	878.1	13200	904.7529	260.8	26.65
J-31	874	6600	902.5027	279	28.5
J-32	871	5760	901.969	303.1	30.97
J-33	878	2040	903.7933	252.4	25.79
J-34	876	1800	903.34	267.6	27.34
J-35	880	1200	903.6931	231.9	23.69
J-36	829.1	6840	902.036	713.8	72.94
J-37	830	4200	901.763	702.3	71.76
J-38	850	4200	901.7067	506	51.71
J-39	850	15720	901.0643	499.8	51.06
J-40	830	5400	901.7389	702.1	71.74

J-41	877.6	4800	904.7347	265.6	27.13
J-42	877	3600	904.7388	271.5	27.74
J-43	875	2760	904.3492	287.2	29.35
J-44	880.1	1200	903.8302	232.2	23.73
J-45	997	17400	1024.9882	273.9	27.99
J-52	996.2	9600	1024.9998	281.9	28.8
J-53	1000	24000	1024.9873	244.5	24.99
J-54	998	16800	1024.9876	264.1	26.99
J-55	995.9	4560	1024.9869	284.7	29.09
J-56	979.9	18000	1024.9858	441.2	45.09
J-57	970	0	1024.9984	538.3	55
J-58	963	0	1024.819	605	61.82
J-59	957	12000	1024.8185	663.7	67.82
J-60	959.8	9600	1024.784	636	64.98
J-61	967	0	1024.7816	565.5	57.78
J-62	987	21600	1024.7788	369.7	37.78
J-63	980	9000	1024.784	438.3	44.78
J-64	975	26400	1024.8175	487.6	49.82
J-65	895.2	10200	910.199	146.8	15
J-66	893.7	9600	910.4017	163.5	16.7
J-67	900	58800	918.7437	183.4	18.74
J-68	892.35	16440	924.9833	319.4	32.63
J-69	910	10800	924.9903	146.7	14.99
J-70	890	0	910.3986	199.6	20.4
J-71	885.9	34800	910.3952	239.7	24.5

J-73	896.5	28440	929.5101	323.1	33.01
J-74	891.5	22800	926.0714	338.3	34.57
J-75	871.2	12000	925.0488	527	53.85
J-76	984	19200	1024.8823	400.1	40.88
J-77	971.5	11400	1024.8475	522.1	53.35
J-78	959.6	16200	1024.8224	638.3	65.22
J-79	960.8	24000	1024.9914	628.2	64.19
J-80	970	6000	1024.9934	538.2	54.99

Current Time: 9.000 hours

Label	Elevation (m)	Demand (L/d)	Hydraulic Grade (m)	Pressure (kPa)	Pressure Head (m)
J-1	853	24000	881.286	276.8	28.29
J-7	859.7	38160	881.259	211	21.56
J-8	856.7	5400	881.2744	240.5	24.57
J-11	852.65	19920	881.3904	281.3	28.74
J-12	851.5	8160	881.3353	292	29.84
J-13	876	13080	895.8578	194.3	19.86
J-14	874	14880	895.6782	212.2	21.68
J-15	872.6	21000	895.6773	225.9	23.08
J-16	873	10800	895.9925	225	22.99
J-17	871	23280	895.988	244.6	24.99
J-23	870	10200	907.7289	369.2	37.73
J-24	868	21360	907.7071	388.6	39.71
J-25	878	3600	907.7354	291	29.74
J-26	876	3600	907.6816	310.1	31.68
J-27	874	1920	907.6581	329.4	33.66
J-28	878.1	13200	907.753	290.2	29.65
J-31	874	6600	905.5029	308.3	31.5
J-32	871	5760	904.9692	332.5	33.97
J-33	878	2040	906.7929	281.8	28.79
J-34	876	1800	906.3394	296.9	30.34
J-35	880	1200	906.6929	261.2	26.69
J-36	829.1	6840	905.0355	743.2	75.94

J-37	830	4200	904.7624	731.7	74.76
J-38	850	4200	904.7062	535.4	54.71
J-39	850	15720	904.0646	529.1	54.06
J-40	830	5400	904.7384	731.5	74.74
J-41	877.6	4800	907.735	294.9	30.13
J-42	877	3600	907.739	300.8	30.74
J-43	875	2760	907.3491	316.6	32.35
J-44	870	1200	906.8301	360.5	36.83
J-45	997	17400	1031.6667	339.3	34.67
J-52	996.2	9600	1031.6782	347.2	35.48
J-53	1000	24000	1031.6658	309.9	31.67
J-54	998	16800	1031.666	329.5	33.67
J-55	995.9	4560	1031.6654	350	35.77
J-56	979.9	18000	1031.6643	506.6	51.76
J-57	970	0	1031.6769	603.6	61.68
J-58	963	0	1031.4974	670.4	68.5
J-59	957	12000	1031.4969	729.1	74.5
J-60	959.8	9600	1031.4625	701.4	71.66
J-61	967	0	1031.46	630.9	64.46
J-62	987	21600	1031.4573	435.1	44.46
J-63	980	9000	1031.4624	503.7	51.46
J-64	975	26400	1031.496	552.9	56.5
J-65	895.2	10200	927.3961	229	32.2
J-66	893.7	9600	927.2483	211.9	33.55
J-67	900	58800	922.8231	223.4	22.82

J-68	892.35	16440	920.6858	277.3	28.34
J-69	910	10800	920.6837	104.6	10.68
J-70	890	0	927.2452	241.2	37.25
J-71	885.9	34800	927.2418	404.6	41.34
J-73	896.5	28440	924.0194	269.3	27.52
J-74	891.5	22800	921.4592	293.2	29.96
J-75	871.2	12000	920.716	484.6	49.52
J-76	984	19200	1031.5608	465.5	47.56
J-77	971.5	11400	1031.526	587.5	60.03
J-78	959.6	16200	1031.5009	703.7	71.9
J-79	960.8	24000	1031.6698	693.6	70.87
J-80	970	6000	1031.6719	603.6	61.67

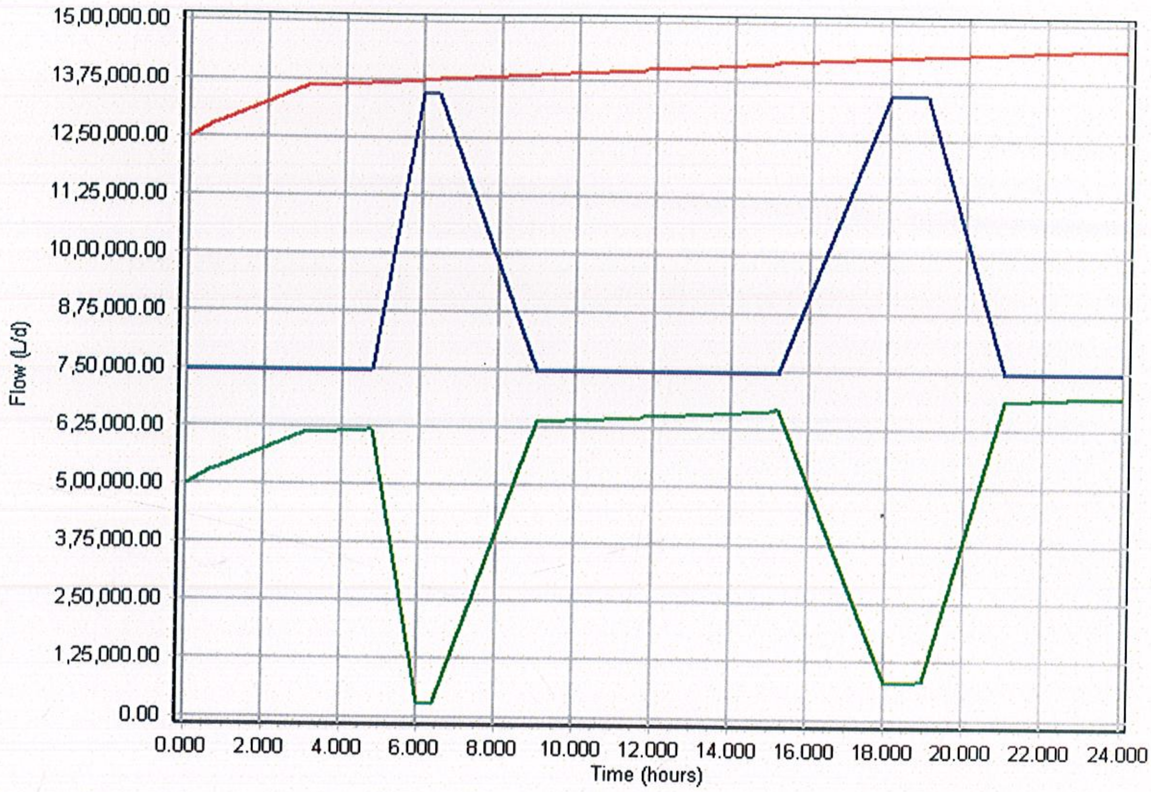
Calculation Summary (1: Base)

Time (hours)	Balanced?	Trials	Relative Flow Change	Flow Supplied (L/d)
All Time Steps(83)	TRUE	451	0.0006499	1403108.38
0.000	TRUE	7	0.0000701	1250540.11
0.631	TRUE	3	0.0000471	1277552.28
0.864	TRUE	4	0.0000046	1286115.29
3.000	TRUE	6	0.0004482	1359653.04
3.096	TRUE	4	0.0000257	1360107.6
4.669	TRUE	19	0.0000733	1367561.12
4.736	TRUE	7	0.0000638	1367881.77
4.755	TRUE	5	0.0005488	1367968.35
4.756	TRUE	6	0.0000549	1367973.92
4.756	TRUE	3	0.0000183	1367976.59
6.000	TRUE	7	0.0000464	1373596.76
6.055	TRUE	4	0.0000186	1373842.88
6.369	TRUE	6	0.0005489	1375207.7
6.410	TRUE	7	0.0000621	1375385.03
6.422	TRUE	5	0.0005536	1375435.19
6.424	TRUE	6	0.0000605	1375440.43
6.424	TRUE	5	0.0005539	1375445.25
9.000	TRUE	7	0.0000663	1386552.02
9.761	TRUE	6	0.0006112	1389713.69
9.792	TRUE	7	0.0000605	1389846.1
9.802	TRUE	5	0.0006041	1389882.45
9.802	TRUE	6	0.0000649	1389884.61
11.661	TRUE	19	0.0006248	1397433.29
11.733	TRUE	7	0.000054	1397992.73
11.755	TRUE	6	0.0004967	1398145.77
11.756	TRUE	6	0.0000536	1398144.11
11.756	TRUE	3	0.0000169	1398148.1
11.777	TRUE	7	0.0000356	1398291.83
11.778	TRUE	3	0.0000138	1398301.31
11.779	TRUE	1	0.00021	1398307.47
11.784	TRUE	6	0.0005035	1398342.9
11.784	TRUE	6	0.0000455	1398345.39
11.784	TRUE	3	0.0000231	1398339.74
12.000	TRUE	7	0.0000443	1399833.07
12.008	TRUE	4	0.000018	1399873
12.013	TRUE	5	0.0005109	1399898.45
12.013	TRUE	3	0.0000268	1399896.12
12.014	TRUE	1	0.0000545	1399904.44
12.065	TRUE	6	0.0005915	1400147.81
12.067	TRUE	7	0.0000655	1400162.45
12.068	TRUE	3	0.0000263	1400157.79

12.068	TRUE	6	0.000042	1400165.77
12.068	TRUE	3	0.00002	1400162.78
12.069	TRUE	6	0.0000661	1400171.43
15.000	TRUE	6	0.0006499	1414287.15
15.113	TRUE	7	0.0000622	1414685.56
15.147	TRUE	5	0.0006363	1414807.67
15.148	TRUE	6	0.0000697	1414817.48
15.149	TRUE	3	0.0000217	1414821.47
15.186	TRUE	6	0.0000459	1414956.05
15.187	TRUE	3	0.0000149	1414954.22
15.188	TRUE	1	0.0000408	1414962.54
15.197	TRUE	5	0.0006315	1414992.48
15.197	TRUE	6	0.000062	1414991.48
15.197	TRUE	3	0.0000206	1414991.15
18.000	TRUE	7	0.000039	1425084.34
18.117	TRUE	4	0.0000161	1425487.41
18.215	TRUE	6	0.0005329	1425839.41
18.228	TRUE	4	0.0000169	1425876.17
18.238	TRUE	5	0.0005314	1425918.92
18.239	TRUE	3	0.0000127	1425920.75
18.240	TRUE	5	0.0005296	1425921.92
18.241	TRUE	3	0.0000194	1425917.76
18.241	TRUE	1	0.000031	1425922.25
18.842	TRUE	6	0.0006137	1428025.76
18.918	TRUE	7	0.0000631	1428290.09
18.941	TRUE	5	0.0006051	1428365.78
18.944	TRUE	6	0.0000668	1428377.43
18.945	TRUE	5	0.0006019	1428386.08
21.000	TRUE	7	0.0000637	1435496.42
21.620	TRUE	6	0.0006315	1437641.68
21.644	TRUE	7	0.0000685	1437721.03
21.652	TRUE	5	0.0006244	1437750.64
21.652	TRUE	6	0.0000744	1437753.47
22.553	TRUE	6	0.0006385	1440820.65
22.588	TRUE	7	0.0000666	1440933.77
22.598	TRUE	5	0.0006368	1440973.86
22.599	TRUE	6	0.0000669	1440976.86
22.599	TRUE	3	0.0000153	1440979.52
22.611	TRUE	6	0.0000469	1441015.62
22.612	TRUE	3	0.0000206	1441018.94
22.612	TRUE	1	0.0000258	1441016.95
22.615	TRUE	5	0.0006358	1441027.26
24.000	TRUE	7	0.0000705	1445647.83

Flow Demanded (L/d)	Flow Stored (L/d)
897659.9	505415.01
748319.88	502142.12
748319.88	529206.99
748319.88	537755.32
748319.88	611333.2
748319.88	611744.13
748319.88	619196.28
748319.88	619514.76
748319.88	619607.38
748319.88	619618.73
748319.88	619626.88
1345679.97	27887.02
1345679.97	28123.66
1345679.97	29467.52
1345679.97	29668.56
1345679.97	29712.01
1345679.97	29721.42
1345679.97	29745.61
748319.88	638173.66
748319.88	641379.29
748319.88	641480.05
748319.88	641520.52
748319.88	641512.74
748319.88	649129.38
748319.88	649604.89
748319.88	649739.64
748319.88	649835.37
748319.88	649811.04
748319.88	649958.1
748319.88	649958.26
748319.88	649970.49
748319.88	649949.95
748319.88	649997.86
748319.88	650021.39
748319.88	651457
748319.88	651537.19
748319.88	651530.78
748319.88	651529.45
748319.88	651515.39
748319.88	651792.74
748319.88	651799.02
748319.88	651828.76
748319.88	651767.29
748319.88	651852.55
748319.88	651834.62

748319.88	665927.35
748319.88	666336.24
748319.88	666466.32
748319.88	666440.29
748319.88	666507.25
748319.88	666560.69
748319.88	666618.37
748319.88	666634.63
748319.88	666644.98
748319.88	666635.71
748319.88	666639.2
1345679.97	79351.75
1345679.97	79781.57
1345679.97	80125.67
1345679.97	80162.72
1345679.97	80174.07
1345679.97	80215.15
1345679.97	80236.99
1345679.97	80189.66
1345679.97	80231.55
1345679.97	82308.21
1345679.97	82543.24
1345679.97	82660.86
1345679.97	82674.76
1345679.97	82668.13
748319.88	687134.87
748319.88	689266.99
748319.88	689386.89
748319.88	689398.49
748319.88	689402.02
748319.88	692501.02
748319.88	692598.5
748319.88	692618.71
748319.88	692653.4
748319.88	692609.06
748319.88	692679.06
748319.88	692689.41



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6,25,000.00
5,00,000.00
3,75,000.00
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1,25,000.00
0.00
Flow (L/d)
0.000 2.000 4.000 6.000 8.000 10.000 12.000 14.000 16.000 18.000 20.000 22.000 24.000
Time (hours)