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October 31, 2006
VIA HAND DELIVERY

Blanca S. Bayo, Director
Division of the Commission Clerk
and Administrative Services
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

Re: PSC Docket No. 050862-WU; Application for Staff Assisted Rate Case in Marion County by County-Wide Utility Co., Inc.
Our File No. 40097.01

Dear Ms. Bayo:

Attached is a hard copy and an electronic version on CD of the Cost/Benefit Analysis of Water Supply Alternatives prepared by the Utility's outside consulting engineer, as we had promised to provide to staff. This report basically updates the information contained in the 1998 Master Plan Analysis, in order to show the staff the considerations undertaken by the Utility at the time of choosing an alternative, for the continued provision of water service to the customers of County-Wide Utility Co., Inc.

I believe the staff will be able to see from this Analysis that the decision by the Utility to receive bulk water from the City of Ocala was by far the most viable alternative to be able to continue to provide service to its existing customers (even before consideration of the obligation to meet the needs of it's future customers) based upon not only the 1998 report conclusions but also those issues that became apparent after that report was finished.

If you or any staff members have any questions in this regard or need any further information, please let me know.

Sincerely,
ROSE, SUNDSTROM & BENTLEY, LLP

F. Marshall Deterding
For The Firm

FMD/tms
cc: Rosanne Gervasi
Troy Rendell
Shannon Hudson
Gerald Edwards
Dirk Leeward

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Engineering Report

Cost/Benefit Analysis of Water Supply Alternatives

Prepared For:
County-Wide Utility Company, Inc.

Prepared By:
Kimley-Horn and Associates, Inc.

October 2006
Project No. 042913001

Kimley-Horn
and Associates, Inc.

Kimley-Horn
and Associates, Inc.

Engineering Report

Cost/Benefit Analysis
of Water Supply Alternatives

Prepared For:
County-Wide Utility Company, Inc.

Prepared By:
Kimley-Horn and Associates, Inc.
4431 Embarcadero Drive
West Palm Beach, Florida 33407
Certificate of Authorization No. 696
(561) 845-0665

October 2006

John E. Potts, P.E. 10/26/06
PE #22881

Kimley-Horn
and Associates, Inc.

John E. Potts, P.E.

Professional Credentials

Bachelor of Science, Mechanical Engineering, University of S. Alabama, 1972

Professional Engineer in Florida and Louisiana

Professional Organizations

American Water Works Association
Florida Engineering Society
International Desalinization Association
American Membrane Technology Association
Southeast Desalting Association

Special Qualifications

- More than 30 years of water treatment plant design experience.
- Served as project director of one of the largest operating brackish water reverse osmosis plants in the country.
- Served for 8 years on board of directors for the American Desalination Association; Chairman of the American Waterworks Association Desalting Committee for 3 years; member of the International Desalting Association; Board member of the Southeast Desalting Association.
- 24 years tenure at Kimley-Horn and Associates

Introduction

John Potts, P.E. — Few water experts know more about the ins and outs of utility system design, operation, and start-up in South Florida than John Potts. He has over 30 years of utilities experience and is recognized as one of the country's leading water experts, specifically in the field of advanced water treatment. In addition to his duties as Town Engineer, his experience with pumping stations and utility design was utilized on numerous major projects throughout the Town. . His extensive experience includes serving as quality control reviewer for our services on the North Martin County RO plants and Tropical Farms RO plant. He has gone on to serve South Martin Regional Utility, assisting them with their plant expansion and designing the first ever ocean outfall for reverse osmosis concentrate. Mr. Potts has intimate knowledge of water utility systems, having served as Utility Director to South Martin Regional Utility after its inception in 1998.

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I. EXECUTIVE SUMMARY

County-Wide Utility Co., Inc. (CWU) approached the issue of how to most economically and viably continue serving its customers in a responsible and prudent fashion by commissioning the preparation of a Master Plan report in 1998. That report clearly indicated which courses of action would be the most economical to CWU customers based on facts and circumstances at that time. The Utility acted in a progressive fashion to resolve details associated with the most viable alternatives and frequently re-examined alternatives to gain assurance that no significant changes had or were occuring in any of the alternatives. CWU acted in a responsible fashion to implement the purchase of bulk water from the City of Ocala as the best alternative available to meet the needs of existing and future customers. Bulk service from the City of Ocala was the most economical in 1998 and remained the most economical in 2005. However, as presented in this report, the advantages of bulk service have increased substantially because of additional costs of reconstructing the obsolete water plant that came to light after 1998.

This Cost/Benefit Analysis re-examines the issues CWU considered such as the age of the existing facilities, the needs of existing customers, and the expectation of new customers within the Service Territory. It also considers the costs of regulations imposed by the Florida Department of Environmental Protection (FDEP), the Southwest Florida Water Management District (SWFWMD), and Marion County at the time of the 1998 report that the report failed to address and additional costs related to regulations implemented subsequent to that report.

CWU's system was originally built in 1973 to serve a 275 unit mobile home subdivision known as Bahia Oaks and consisted of two (2) water supply wells, a hydro pneumatic tank and a chlorine pump. No significant changes or modifications have been made to the water supply or treatment components utilized by the Utility in providing water service to its customers since they were originally installed in 1973. The system now has 480 customers.

In 1998, the water supply facilities had almost reached their useful life and were in need of substantial renewal, upgrade, and replacement. It was also apparent that additional development would occur within vacant portions of the Utility's Service Territory. The Utility recognized that it was time to begin planning for replacement of the existing water supply equipment in order to maintain service to existing customers as well as making provisions to meet their obilgation to serve new customers within the Service Territory.

Five alternative concepts were examined in the 1998 Master Plan representing a broad range of prudent actions and included four alternatives requiring that the existing wells be maintained in service and two utilizing bulk service.

At first blush it appeared keeping the existing wells was the most cost-effective but the results of the 1998 planning effort indicated that the most cost-effective and reliable means of providing continued service to existing customers, while also fulfilling the obligation of a water utility to provide service to all customers within its Service Territory, was to seek a bulk service agreement. Of the two possibilities, only the City of Ocala remained viable.

This analysis updates the capital costs associated with each of the alternatives to reflect 2005 costs without addressing regulatory requirements missing from the 1998 report or those regulations imposed subsequent to 1998 which would have added substantial additional costs to alternatives. Those 2005 costs are:

Operating a Water Plant
- Alternative One — $747,000 (No fire protection)
- Alternative Two-A — $1,026,000
- Alternative Two-B — Only sufficient through 2003

Operating a Water Plant supplemented with Bulk Service
- Alternative Three-A — Not Viable

Bulk Service
- Alternative Three-B — $704,000

Based on these updated cost estimates, the choice of an interconnection with the City of Ocala for bulk service (Alternative Three-B) was the lowest cost alternative available in 1998 and in 2005 even before additional regulatory costs.

Regulations require that replacement components or modifications to existing components, must meet the then current regulations and cannot be replaced or restored in a configuration which does not meet current regulations. Continued operation of the water plant would have required replacing the wells on a new well site, installing new storage tanks and treatment facilities, emergency generators, and security -- in essence a brand new water plant. This would also invoke Marion County regulations requiring essentially a special exception and special zoning in order to construct the new plant. These Marion County regulations also require that new water treatment facilities be grandfathered out of existence at a future date.

Non-regulatory reasons such as the facilities exceeding the FPSC's useful life guidelines, deterioration of the hydro pneumatic tank, contamination of the water supply wells, lack of fire protection, system reliability and future regulatory costs were also considered by CWU in its decision-making process.

A planning level estimate of the probable cost to construct new water supply, treatment, storage, and pumping facilities, having a production capacity of 650,000 gallons per day, Maximum Day Flow, as projected in the 1998 Master Plan and meeting all current regulations and including the cost of land is $1,300,000.

This report concludes that all existing water production, treatment and storage facilities would have had to be retired and entirely new facilities built had CWU chosen to implement one of the alternatives that maintained the existing facilities. This would have led to much higher costs for existing customers than those predicted in the alternatives examined in 1998 and updated in this report. These higher costs would have become the responsibility of all CWU customers.

II. PURPOSE AND METHODOLOGY

The purpose of this Engineering Report is to examine alternatives that were available to County-Wide Utility Company (CWU) for providing domestic water service to customers within its service area. Age of the existing facilities, imposition of new regulations by Florida Department of Environmental Protection (FDEP)/Southwest Florida Water Management District (SWFWMD) / Marion County, the needs of existing customers, and the expectation of new customers within the Service Territory require that a prudent utility examine how it will continue to meet existing demands as well as other challenges in order to select a course of future action that is cost effective and responsible from the perspective of both the Utility and its customers. This examination of alternatives must be based on not only those regulations applicable to a water utility but also the estimates of cost and benefits associated with each alternative.

This report will examine alternative courses of action developed by County-Wide Utility in a 1998 Master Plan report prepared to assist the Utility in making its decisions and the underlying issues considered in developing that master plan. The alternatives developed in that Master Plan Report (1998 Plan) remain conceptually valid but require updating to take into account subsequent changes in regulations and the current costs associated with implementing each of those alternatives.

III. BACKGROUND

County-Wide Utility Company began operation in 1972 as a private utility with a Service Territory whose first customers included a mobile home subdivsion known as Bahia Oaks. This subdivision served as the main source of new customers for CWU for a number of years. New site-built single-family homes constructed in the Bahia Oaks subdivision also have become customers of the Utility.

The initial water supply facilities constructed in 1973 consisted of two (2) water supply wells, a hydro pneumatic tank, chlorination equipment, and associated support facilities. No significant changes or modifications have been made to the water supply or treatment components utilized by the Utility in providing water service to its customers since they were originally installed in 1973.

In 1998 the water supply facilities had almost reached their useful life and were in need of substantial renewal, upgrade, and replacement. It was also apparent that additional development would occur within vacant portions of the Utility's Service Territory. The Utility recognized that it was time to begin planning for replacement of the existing water supply equipment in order to maintain service to existing customers as well as making provisions to meet their obilgation to serve new customers within the Service Territory. The Utility commissioned preparation of a report which examined the condition of existing water supply, treatment and distribution facilities as well as examined alternatives that could be implemented to replace existing equipment and provide domestic water service to future customers. A copy of that report is attached as Appendix A.

Results of the 1998 planning effort indicated that the most cost-effective and reliable means of providing continued service to existing customers, while also fulfilling the obligation of a water utility to provide service to all customers within its Service Territory, was to seek a bulk service agreement with Windstream Utilities or the City of Ocala. Based on the results of the 1998 report, CWU initially began the process of pursuing a bulk service agreement with both Windstream Utilities and the City of Ocala. Negotiations continued with Windstream Utilities until 2001 when it became apparent that this was only a temporary solution because Windstream expressed an expectation that all of its capacity would eventually be needed to serve its own Service Territory. They would not give us assurance that they would have the fire flow capacity to meet ISO, NFPA, and Marion County requirements. In addition, the per gallon cost of purchased water from WindStream Utilities appeared to be significantly higher than that from the City of Ocala and Ocala had the ability to supply sewer. During these negotiations, Windstream Utilities started construction of their water tower and CWU again tried to negotiate an agreement with them but they were reportedly having water quality problems and still would not provide engineering data to support their fire flow claims. An agreement was reached with Ocala in late 2003.

In early 2002, a developer extended the City of Ocala water transmission system to a point closer to the CWU Service Territory which lowered the cost of this alternative making it continue to appear as the most cost-effective alternative available. In order to receive bulk service from the City of Ocala, CWU would be required to construct a water transmission main to their service area and enter into a bulk service agreement addressing the sale of the water and capacity reservations.

At this time, CWU conducted an internal review of FDEP, Water Management District, and Marion County regulations relative to issues that would affect the feasibility of expanding the existing water plant. A significant detraction to this concept was that Policy 1.4 of the Marion County Comprehensive Plan Potable Water Sub-element and zoning regulations requires a hearing with the Marion County Board of County Commissioners to obtain a Special Use Permit for any property utilized as a water treatment plant. Policy 2.2 requires "existing water treatment plants to connect to a regional or sub-regional system when these systems are available and are economically feasible."

Also included in these considerations was the need to obtain a new Water Management District Water Use Permit with a higher allowable withdrawal to accommodate new customers and the requirement to meet current FDEP regulations.

CWU continued negotiations with the City of Ocala and these reached a conclusion in late 2003. Shortly after that, CWU again reviewed internally the expected costs of other alternatives and again found that connecting to the City of Ocala still represented the most cost-effective course of action.

As the process was nearing completion, CWU filed an application with the Public Service Commission (PSC) to adjust their rates as required to accommodate these changes in the operation of their system. As the rate adjustment process was underway, the PSC inquired as to whether a cost/benefit analysis had been undertaken by the Utility as a precursor to its decision to move forward with purchase of bulk water from the City of Ocala, as opposed to the other alternatives available to the Utility to continue to provide service to its existing customers and/or to provide service to the remaining future customers within its service area. The Utility responded that it had undertaken the 1998 study and that the conclusions reached in that study were based upon informal analysis of the costs and benefits underlying the choices available to the Utility.

The Utility offered to the Commission staff that it would undertake to reduce to writing, the analysis, as well as underlying facts it had considered, in the form of a cost/benefit analysis and an update to the 1998 report. This cost/benefit analysis would examine the alternatives available to the Utility as well as demonstrate that the retirement of its existing water supply/production facilities and purchase of bulk water from the City of Ocala represented the most cost-effective and reliable alternative to meet the needs of the Utility's existing customers. This course of action also represented the best alternative available to meet the long-term needs of the Utility and all of its present and future customers.

IV. ALTERNATIVE CONCEPTS FOR WATER SUPPLY

A. 1998 Master Plan

A total of five alternative concepts that were thought at the time to be sufficient to provide water supply to the CWU system were examined in the 1998 Master Plan:

- **Alternative One** Retain existing wells, install one supplemental well at a new well site, increase hydro pneumatic storage tank capacity, all to supply sufficient capacity to serve existing and future customers with future customers being predominantly residential in nature. This option did not provide any fire protection.
- **Alternative Two-A** Retain existing wells, install one supplemental well at a new well site, increase hydro pneumatic storage capacity, install ground storage tank and high service pumps, all to supply sufficient capacity to serve the existing and future customers with some of the future customers being commercial in nature.
- **Alternative Two-B** Retain existing wells, install one supplemental well at a new well site, install ground storage tank and high service/fire pumping system, all to supply sufficient capacity to serve a portion of future development but inadequate to meet buildout requirements.
- **Alternative Three-A** Retain existing wells, enter into a bulk service agreement with Windstream Utilities, all to supply sufficient capacity for buildout demand in the service territory and provide fire flow protection.
- **Alternative Three-B** Discontinue use of existing wells, enter into a bulk service agreement with City of Ocala to supply sufficient capacity for buildout demand in the service territory and provide fire flow protection.

The following is a summary of the estimated capital costs for each alternative prepared in 1998 (and updated in 2005) plus the cost of land necessary to implement each alternative:

	One	Two-A	Two-B	Three-A	Three-B
New Well and Tank Site	✓	✓			
New Tank Site			✓		
One New Well and Pump	✓	✓			
Replace existing hydro pneumatic tank	✓	✓	✓	✓	✓
Two new 12,000 gal hydro pneumatic tanks	✓				
New 300,000 Gal Ground Storage Tank		✓			
New 75,000 Gal Ground Storage Tank			✓		
New High Service Pumping		✓	✓		
Interconnect to Windstream				✓	
Interconnect to City of Ocala					✓
1998 Cost	$376,608	$608,445	$431,377	$108,291	$310,925
2005 Cost	$747,000	$1,026,000	Only sufficient through 2003	Not Viable	$704,000

These were the alternatives examined by CWU during the process of choosing a course of action as it began the process of planning for the future in 1998. These alternatives represent an adequately broad range of prudent actions and include four alternatives requiring that the existing wells be maintained in service (Alternatives One, Two-A, Two-B, and Three-A) which would, at first blush, appear to include the most cost-effective approaches.

Review of this information confirms that continuing the use of existing water production facilities presented the highest capital cost to CWU customers except for Alternative Three-A.

Alternative Three-A appeared to present the lowest cost; however, as pointed out in the 1998 Master Plan and confirmed by CWU in subsequent negotiations up to 2001, this alternative was determined to not be viable since Windstream Utilities would be forced to discontinue service to CWU in the future as new customers came online within the Windstream Service Territory and the system capacity was needed to serve its own customers. As such, this alternative was only a temporary solution and was not considered viable, as it would be short-term only and require a choice of one of the other alternatives as a permanent solution within a few years. It also did not include any capacity charges that CWU would have had to pay to Windstream. Accordingly, this alternative will not be further evaluated in this report.

Alternative Two-A would only have had sufficient capacity until 2003, so this alternative will not be further evaluated in this report either.

All of the alternatives assumed that the existing wells would remain in service. Alternatives One and Two-A assumed that one new well would be drilled, primarily for the purpose of providing adequate flow to meet fire flow requirements. Only Alterntative Three-B could have allowed for the retirement of the existing plant. The single new well, although designed to also meet fire flow requirements, would supply potable water under peak demand conditions and would be a potable water supply well. It therefore was required to be constructed in accordance with FDEP standards. These alternatives also failed to recognize the immediate need to replace the existing hydro pneumatic tank and to add additional storage to this system, both in hydro pneumatic style and ground storage. Upon further examination, in the years that followed the 1998 plan, it was determined that these changes would be needed to continue serving existing customers in accordance with sound utility practices and FDEP regulations.

It is important to note that the 1998 Plan proposed to maintain the existing wells in service in their present state, condition, and configuration without replacement, upgrade or modification. This assumption allowed the capital cost of each of these alternatives to be minimized in the analysis of each alternative. However, as discussed below in Sections C and D, this approach is not consistent with current regulations and obligations of a utility providing potable water to the public. Many of the current regulations have imposed requirements on the Utility at the present time that would require substantial modification and upgrade to these existing facilities in order to continue to utilize them for service to existing customers.

B. Updated 2005 Capital Costs

CWU began the process of implementing a plan for future action in 2001 based on findings contained in the 1998 Master Plan. Initial efforts allowed elimination of Alternative Three-A as negotiations made it clear that this did not offer a long-term solution. This left Alternative Three-B as the most cost-effective alternative and CWU negotiated at length with the City of Ocala regarding the details of purchasing bulk water in an effort to assure that this alternative was, in addition to being the lowest cost, also was viable in both the short and long terms. Approximately six years passed during which the cost of each alternative increased due to inflation in the utility industry; however, no recalculation of basic costs was undertaken in the interim to reevaluate the cost of each alternative, or more importantly, the underlying assumptions as to the viability of each alternative. As such, the study effectively became outdated.

The following is a summary of the capital costs associated with each of the alternatives updated to reflect 2005 costs only. This section of this report does not update the cost of each alternative to address regulatory requirements not addressed in the 1998 report (and those regulations imposed subsequent to 1998) which would add substantial additional costs to each of the remaining alternatives.

- Alternative One — $747,000 (No fire protection)
- Alternative Two-A — $1,026,000
- Alternative Two-B — Only sufficient through 2003
- Alternative Three-A — Not Viable
- Alternative Three-B — $704,000

Since Alternative Three-B has already been implemented, the summary reflects its actual cost. In order to allow comparison of costs for each alternative, the cost shown for Alternative Three-B does not include the management fee incurred by CWU during planning and construction of this alternative. This cost would have occurred, and therefore been added to, any of the alternatives that was implemented. Details of how each of these costs was calculated are shown in Appendix B. For the purposes of maintaining continuity, no changes were made in the physical facilities required to implement each alternative.

Based on these updated cost estimates, the choice of an interconnection with the City of Ocala for bulk service (Alternative Three-B) was the lowest cost alternative available to CWU even before consideration of additional costs not previously contemplated in 1998 and before the additional regulatory considerations outlined below.

C. Regulatory Considerations

Every water utility carries the obligation of providing its customers safe drinking water on a reliable basis. FDEP regulates water utilities in the state of Florida and its rules are presented in the Florida Administrative Code (FAC). These regulations are enforceable as law and represent the "industry standards" as minimum requirements to protect customers of a water utility. These regulations make certain requirements of a water utility's supply, treatment, storage and pumping facilities which are applicable in determining whether water production facilities can safely and reliably provide service. There follows a discussion of each of the applicable regulations.

1. <u>Redundant Water Supply Wells</u>

FAC 62-555.315(3) states "... In addition, if the water system is a community system serving, or designed to serve, 350 or more persons or 150 or more service *connections, the total well capacity with the largest producing well out of operation shall equal at least the design average daily water demand, and preferably the design maximum day water demand, for the system. ... "*

This regulation is based on the need for standby water supply wells since a water supply well is a mechanical device which can/will fail periodically or need to be taken out of service for maintenance. Any system that depends on all of its mechanical devices being operational in order to meet customer demand is likely to be unable to meet customer demand on occasion. By definition, maximum day water demand is the amount of water required of the water production facilities to meet the needs of the customers on days of maximum demand and this demand does occur on multiple occasions as well as on consecutive days. In order for CWU to reliably provide potable water to its customers, both current and future, there is therefore an obligation to provide redundant water supply wells. Even back in 1998 with only 362 customers, the 1998 reports states in multiple places that CWU's water plant could not meet existing demands with one of the two wells out of service. Since the existing wells are only six inches in diameter and less than 25 feet apart, larger pumps cannot be installed in the existing wells even if other regulations did not prohibit the upgrading of the existing wells.

2. Water Supply Well Setback

FAC 62-555.312(1) states "... Wells that are, or will be, supplying a PWS serving premises with an estimated collective sewage flow greater than 2,000 gallons per day and that were, or will be connected to the PWS on or after December 13, 1983, shall be no closer than 200 feet from any OSTDS, regardless of the location of the OSTDS."

This regulation is based on the need to protect water supply wells from bacteriological contamination present in the discharge of on-site sewer treatment and disposal systems (septic tanks). It is the basis of these regulations, and accepted industry standard, that a 200-foot separation is required to provide the highest degree of assurance that septic tanks will not contaminate the water supply. The existing

CWU wells constructed in 1973 are only 100 feet from septic tanks and do not meet this setback requirement. It would not be responsible for the Utility to assume that this requirement of the regulations does not need to be addressed. It can be assumed to be the obligation of CWU that it should take steps to meet this regulation in order to protect the quality of water sent to its customers.

FAC 62-555.312(4) states "For Wells connected to a community water system on or after August 28, 2003, except those connected under a construction permit for which the Department received a complete application before August 28, 2003, continuing protection of the well from the sanitary hazards described in subsection (3) above shall be provided during the entire useful life of the well through one of the following means:

(a) ownership by the water supplier of all land within 100 feet of the well;
(b) control by the water supplier of all land within 100 feet of the well via easements, lease agreements, or deed restrictions that appropriately limit use of the land;
(c) well head protection, zoning, or other land use regulations that appropriately limit use of all land within 100 feet of the well; or
(d) other appropriate means."

This regulation is intended to assure that the water supply utility has absolute control over what occurs within close proximity to its water supply wells in order to protect its wells from any future source of contamination. As a private utility, the only method available to CWU is to own the property as called for in (a) above since it has no zoning authority and restricting use of a property reduces its value. This report has identified that because of the presence of multiple septic tanks, a setback of 200 feet is appropriate for any well installed in this area. The distance from the existing wells to the well site property line is less than 25 feet and the well site cannot be expanded because it is surrounded by homes. Alternatives One and Two-A would thus require construction of an entirely new water plant on a new site of sufficient size to meet all setbacks.

Accordingly, for the purposes of this report it will be assumed that two wells, 400 feet apart, will be located on a piece of property purchased by CWU. This well separation is needed to avoid drawdown interference.

3. Finished Water Storage

FAC 62-555.320(19)(a)2. states "...For small water systems with hydro pneumatic tanks that are installed under a construction permit for which the Department receives a complete application on or after August 28, 2003, the supplier of water or construction permit applicant also shall demonstrate that, in conjunction with the capacity of the water system's source, treatment, and finished-water pumping facilities, the water system's total useful finished water storage capacity (i.e., the water system's total of active hydro pneumatic tank volume) is sufficient to meet the water system's peak instantaneous water demand for at least 20 consecutive minutes. ".

This regulation is based on the need to provide both contact time for the chlorine disinfectant to be effective and to provide a storage capacity capable of overcoming extraordinarily high demands or momentary failure of water supply equipment. CWU would not be prudent to ignore the need for chlorine contact time so that the effectiveness of the disinfecting the water is achieved to maintain compliance with existing regulations or the need for sufficient storage to overcome extraordinary circumstances in the operation of the water supply system. Accordingly, for the purposes of this report, the existing 35-year-old 5,000-gallon unlined hydro pneumatic tank is assumed to be replaced with a 7,500-gallon lined tank.

D. Summary of Regulatory Considerations

Each of the four regulations discussed in the above section of this report applies directly to the CWU facilities. There is ample evidence and reason that the existing CWU wells would have to be replaced in order to protect the drinking water supply. Replacement wells would require not only the cost of new construction, but also the purchase of land in order to protect the wells against future contamination as required by the regulations. If the Utility was to continue to utilize its own treatment and source of supply facilities, it had become apparent upon inspection that replacement of the hydro pneumatic tank was urgently needed and could not be replaced without addressing the new regulations which would require a larger tank. Replacement of these two components constitutes construction of a new water supply and treatment system which then invokes the other regulations which apply to construction of a new water supply and treatment facility. These include FDEP regulations regarding disinfection facilities, emergency generation facilities, security, and finished water storage. This would also invoke the Marion County regulations which require essentially a special exception and special zoning in order to construct a new water treatment plant. These Marion County regulations also require that new water treatment facilities be grandfathered out of existence at a future date certain.

In regards to the issue that FDEP sometimes allows an existing water system to operate outside of the requirements of current regulations, in practice FDEP regularly does impose the new regulations on existing water systems.

There is no doubt that the existing CWU water supply and production facilities would have to be replaced based on their condition, current regulations, or combination of both. Accordingly, any alternative for future action that included maintaining the existing water supply and production facilities would have resulted in a significant cost increase to CWU customers shortly after it was implemented. These costs would have been above and beyond those considered in the 1998 report.

A planning level estimate of the probable cost to construct new water supply, treatment, storage, and pumping facilities, having a production capacity of 650,000 gallons per day, Maximum Day Flow, as projected in the 1998 Master Plan and meeting all current regulations is $1,300,000. This includes the cost of land on which to construct the facilities. As such, each of the Alternatives available to CWU, other than the interconnection and bulk service from the City, would have had those additional costs above and beyond those envisioned in 1998.

E. Non-Regulatory Considerations

Previous portions of this report described why CWU had an obligation to address regulations that were in effect when it began implementing its plan in 2002 for the future of its system through connection to the City of Ocala in 2005. However, the issue can be raised that FDEP regulations allow water systems to continue in operation with facilities that do not meet current regulations, until or unless the water system owner submits an application to modify or replace components of the water system. Replacement components or modifications to existing components, must meet the then current regulations and cannot be replaced or restored in a configuration which does not meet current regulations. CWU considered this issue in its decision-making process and it was apparent that the anticipated need to address renewal and replacement of facilities which had outlived their useful lives would have to include upgrade of those existing facilities to meet current regulations. There were several of these non-regulatory reasons why the existing water supply system would require replacement, then or in the near future, that were considered by CWU in its decision-making process.

1. Useful Life

All of the water supply, storage, chlorination, and pumping components of this water system had been in service well beyond their useful life in accordance with PSC useful life criteria. According to PSC guidelines, the water supply wells have a useful life of approximately 27 years and by 2005 the two water supply wells and associated treatment and storage facilities had exceeded that life by 19%. According to this criteria, all components of the water supply system were in need of replacement.

2. Hydro Pneumatic Tank Condition

Once thoroughly inspected, it became clear that the unlined hydro pneumatic tank was physically deteriorated and leaking which meant corrosion had reached a critical stage. Replacement of this tank was required and the replacement tank would fall under the current FDEP regulations.

3. Water Supply Well Contamination

The water supply wells had begun to occasionally test positive for coliform bacteria. This is a strong indication that the well casings had deteriorated and were allowing surficial groundwater to leak into the well production zone. Additionally, the well surface casings were only 60 feet deep, which is very shallow for a water supply well. Construction of replacement wells would have to be in accordance with current regulations. CWU was also aware of two new water supply wells for a mobile home park only 1,600 feet north of the existing water plant that have been unable to meet water quality standards.

4. Fire Protection

Current regulations require all new subdivisions to include fire protection facilities provided by the water utility. When Bahia Oaks was constructed, this requirement was not present and therefore no fire protection was provided, either in the distribution piping or plant production facilities. The existing water production facilities were not capable of supporting fire flow requirements.

5. Separate Water Systems

There was some consideration that the existing the water production facilities serving the customers existing around 2003 could have been left as is and entirely new facilities constructed to serve all customers connecting to the system after that date.

This would however require operation and maintenance of two separate water systems within the CWU Service Territory, and each of the two separate water systems would provide a different level of service. It would not have been possible to interconnect these two systems because of the potential for differing water qualities and the certainty of varying operating pressures in each system. This concept would also create dual piping systems as distribution facilities of one system pass through the other system in order to serve new customers on vacant lots that were embedded in those areas served by the initial water system. Use of this concept would certainly create separate classes of customers within the CWU Service Territory, and likely would have increased capital costs as well as operating costs substantially above all other alternatives considered.

6. System Reliability

FDEP regulations require longer on-site presence of licensed water system operators as the system production capacity increases. This means that the larger water systems are manned by operators capable of reacting to emergency conditions. These regulations are based on several considerations, one of which is the need to create a more reliable water system as the number of customers served by that system increases. Clearly the existing CWU system is small and requires only brief visits of a licensed operator on certain days of the week. While this reduces operating costs, it diminishes system reliability since there is no one present to react to equipment malfunction or other emergency conditions.

Larger systems are also required to have significantly greater redundancy of equipment as well as the ability to redirect existing facilities in order to continue water production, even at a reduced capacity. Larger systems employ full-time maintenance personnel which is another method of increasing system reliability. Customers of the system benefit from this reliability by having significantly reduced occurrences of outages. CWU customers benefit by having a more reliable water production facility serving them when connected to the City of Ocala.

7. Future Regulatory Costs

This country, as evidenced by rules promulgated by the United States Environmental Protection Agency, has a conviction that it will have the best quality drinking water in this world. Toward this end, regulations are constantly changing, additional compounds present in water are being regulated each year, monitoring requirements are becoming increasingly frequent, and security requirements are being imposed on water supply systems. This national objective is certainly to the benefit of American citizens; however, it comes at a price, since the cost of water must reflect the water company's cost to meet these regulations. A large system such as the City of Ocala is much better prepared to implement new processes, monitoring of water quality, or other improvements mandated by the regulations and to do so at a lesser cost than CWU would be.

CWU customers benefit by having a large number of customers assisting in paying the costs associated with meeting new regulations.

F. Summary

CWU approached the issue of how to most economically and viably continue to serve its customers in a responsible and prudent fashion by commissioning preparation of a Master Plan report in 1998. That report clearly indicated which courses of action would be the most economical to CWU customers based on facts and circumstances at that time. The Utility acted in a progressive fashion to resolve details associated with the most viable alternatives and frequently re-examined alternatives to gain assurance that no significant changes had or were occuring in any of the alternatives. CWU acted in a responsible fashion to implement the purchase of bulk water from the City of Ocala as the best alternative available to meet the needs of existing and future customers. The alternatives available that were most economical in 1998 remained the most economical in 2005. However, as noted herein, the advantages of bulk service have increased substantially because of additional costs of the other alternatives that came to light after 1998.

It is important to note that the comparative costs presented in this report assume keeping the existing water production facilities in their deteriorated state. Even without accounting for the need to retire the existing plant, those alternatives were and remain more costly to CWU customers than the purchase of bulk water from the City of Ocala.

This report identifies and describes considerations that would have ultimately required retirement of all existing water production, treatment and storage facilities and construction of entirely new facilities had CWU chosen to implement one of the alternatives that maintained the existing facilities. This would have led to much higher costs for existing customers than those predicted in the alternatives examined in 1998 and updated in this report. These higher costs would have become the responsibility of all CWU customers.

Appendix A

Water System Capacity Analysis and Master Plan Report

County Wide Utility Co. Inc.
Bahia Oaks Water System
WUP 203239.01
PWS 6420103

September, 1998
Prepared for County-Wide Utility Co. Inc. by:

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Filename: C:\MGI\coutil-bahia\coutilcaprep.wpd

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Introduction

General

The purpose of this report is to provide a capacity analysis of the existing water supply system serving the Bahia Oaks subdivision in Marion County Florida.

Bahia Oaks is located approximately 3 miles South of Ocala City limits on the North side of SR 200.

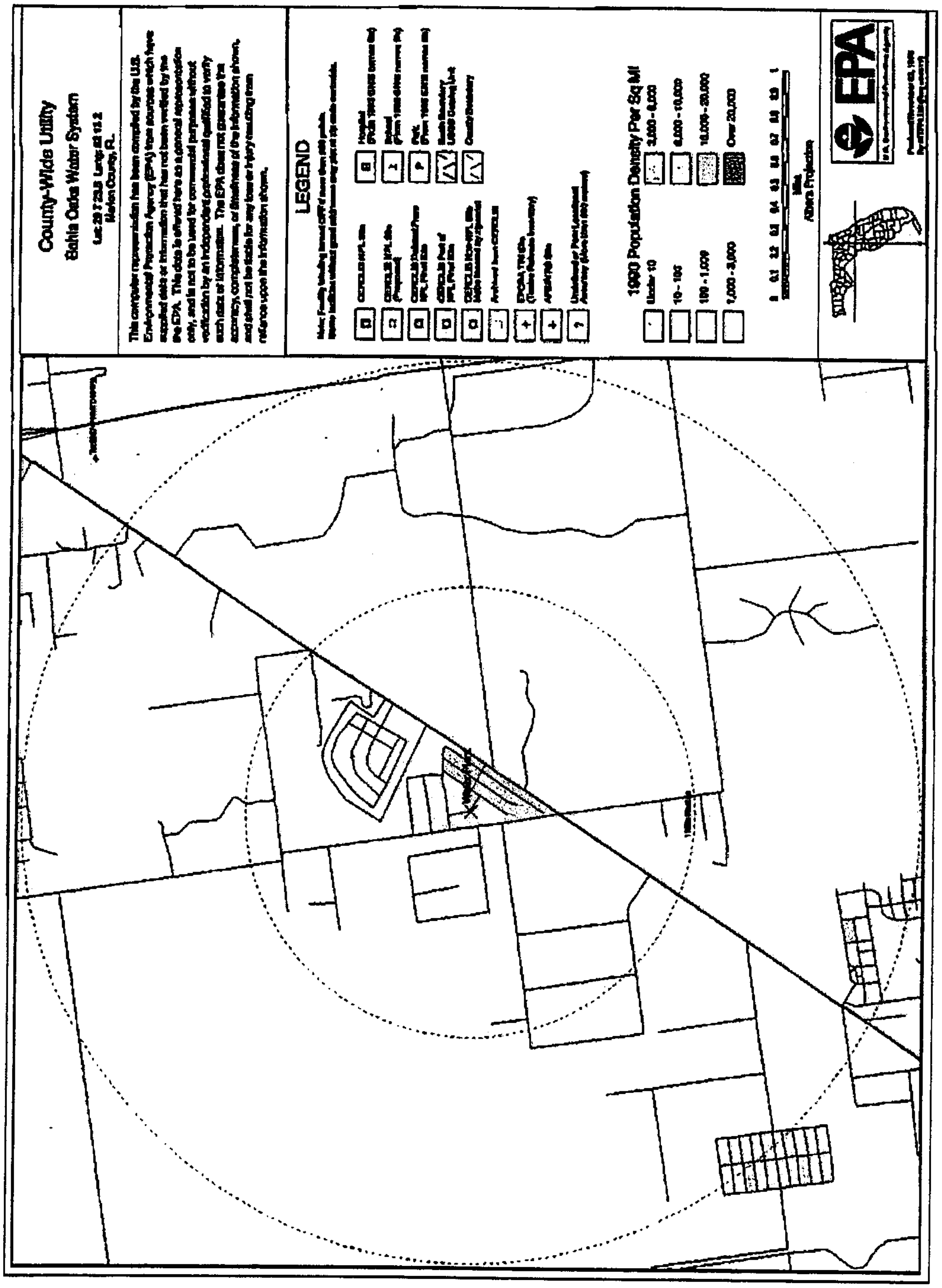
A USGS/EPA Map and site aerial is provided on the following pages.

The scope of this report includes:

- Perform historical analysis of past water usage, annual average, maximum day and peak hourly demand
- Analyse future water system demand, based on PSC certificated service area, and particular development plans supplied by the Owner.
- Perform capacity analysis of existing water plant, in terms of water well, tankage, disinfection, plant yard piping, standy power systems, as well as current WMD water use and FDEP permitted capacity
- Perform a capacity analysis of existing distribution system
- Review site limitations in terms of ability to add tankage, equipment, wells
- Develop 4 alternatives and prepare Engineer's Opinion of Probable Cost for same.

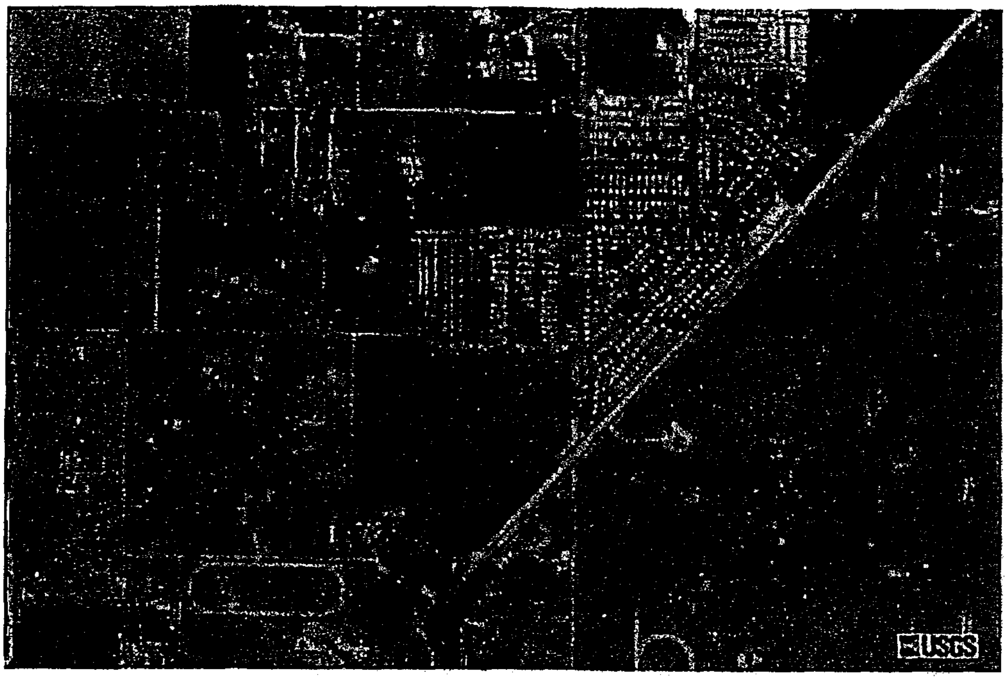
Authorization

This report has been prepared by McDonald Group International, Inc. George J. McDonald, P.E., as authorized by County-Wide Utility Co. Inc, owner of the water system, in June of 1998.


County-Wide Utility
Bahia Oaks Water System
LEGEND
1990 Population Density Per Sq Mi
Under 10
10 - 100
100 - 1,000
1,000 - 3,000
3,000 - 6,000
6,000 - 10,000
10,000 - 20,000
Over 20,000
Miles
Albers Projection
EPA

Description of Service Area and Historical Water Demand

The existing service area provides service to primarily residential users. The aerial photo below illustrates the boundaries of the service area and the approximate level of development within the boundaries.



The system presently provides service to approximately 362 customers .

Data provided by the Utility (12 months 5/97-4/98) and the SWFWMD was used to ascertain the following statistical average demands:

Annual Average Daily Flow	83,879 gpd (12 months 5/97-4/98)
Maximum Month Demand	129,600 gpd
Maximum Day Demand	181,000 gpd

(See appendix for raw data used).

From the foregoing, the annual average water consumed per connection is 232 gpd. Development within the certificated areas is in two groups, the earlier units, primarily mobile homes, which appear to use less water, and the more recent development, consisting of conventional homes and which use higher amount of water.

Reviewing customer records, it appears that the average use of the earlier units is 171 gpd each while the newer conventional homes use 372 gpd each.

Peak instantaneous demands consist of ordinary maximum diurnal flow and unusual loads caused by irrigation demands.

During normal weather periods, peak hour demand is likely no more than three times the average annual daily demand, or 175 gallons per minute.

During prolonged dry weather periods, the system is known to experience a heavy irrigation demand.

Estimating the instananeous irrigation demand for this service area involves a mix of assumptions about frequency of lawn irrigation by individual consumers, net demand per irrigated lot, and assigning a percentage of lots irrigated based on a reasonable least probable maximum number of lots simulataneously irrigated. The assumptions also need to consider that the existing supply system (discussed in subsequent sections) only infrequently operates at maximum capacity (about 500 gpm).

All considered, the peak hour demand with irrigation load for this service area is estimated as follows:

Maximum percent lot owners simultaneously irrigating	13.5%
Assumed net demand per irrigated lot	8 gpm
Number of lots	362
Irrigation demand	391 gpm

To this must be added the demand during the maximum day to account for ordinary domestic consumption, or 126 gpm.

Total instantaneous maximum demand is therefore probably less than 517 gpm.

Future Projected Water Demand

Future projected water demand is based on growth that occurs:

- within the existing service area where infrastructure to deliver water has already been installed, and
- in areas where new development has been identified

Within the portion of Bahia Oaks where infrastructure already exists, there appear to be a total of 489 lots based on lot counts within blocks of a drawing prepared by Newman Consulting Engineers.

Development within the certificated areas is in two groups, the earlier units, primarily mobile homes, which appear to use less water, and the more recent development, consisting of conventional homes and which use higher amount of water.

Reviewing patterns of consumption, buildout of the existing service area can be forecasted as follows:

Average Number of Current Low Usage Customers	252
Average Number of Higher Usage Customers	109
Average Demand/Per Connection, Low Usage Customers	171
Average Demand/Per Connection, High Usage Customers	371
Buildout Number of Low Usage Customers	272
Build out AADF, Low Usage Customers	46,635
Buildout Number of High Usage Customers	217
Buildout AADF, High Usage Customers	80,460
Buildout AADF	**127,095 gpd**

292
+ 109
+

489 534

Assuming current consumption patterns remain the same, the annual average , maximum month and maximum day demand of the above would be as follows:

Buildout AADF	**127,095 gpd**
Buildout Max Month	**196,373 gpd**
Build out Max Day	**274,255 gpd**

In the undeveloped portions of the service area, the Owner has identified a number of likely development projects, consisting of a mix of residential and commercial development. A tabulation of that development and estimated demand, based on two different development options, is as follows:

Combining the demand from the existing service area and the proposed development, build out demand is likely to be as follows for this optional development scenario:

Developing Parcels in PSC Area: Development Option A

	No Units	*gpd/unit*	*Total*
Area comprising blocks 25-27, parts 28-30 residential units	95 residences	371	35,224
Multifamily, parts of blocks 28-30,21,22,32,24 residential units (assume 8 units/ac)	312 residences	232	72,322
Department Store, 100000 sf, 0.038 ERC/100 sf	38 (100s SF)	350	13,300
Commercial Frontage, acres	7acres	2,750	19,250
Grocery Store, sf	50,000 sf	0.16	8,000
Restaurants, 2 at 120 seats each	240 seats	75	18,000
Handiways	2 each	4,000	8,000
Offices, 3 AC, 4 ERU/ac	12 offices	350	4,200
Five ac parcel, E/side SR 200	15 ERUs	350	5,250
		Subtotal Demand, gpd	*183,546*

SUMMARY - Development Option A

	AADF	MMF	MDF
Current Service Demand	83,879	129,600	181,000
Additional, Build out (phase 3B)	43,216	66,773	93,255
Future Addition	183,546	283,595	396,070
Total	**310,641**	**479,968**	**670,325**

(Notes: AADF, Annual Average Daily Flow, MMF, Maximum Monthly Flow, MDF, Maximum Daily Flow)

Under a second development scenario which anticipates more residential demand and less commercial, the following total demand is estimated:

Developing Parcels Future Addition: Development Option B

	No Units	*gpd/unit*	*Total*
Lots in Blocks 21-30 residential units	317 residences	371	117,538
Commercial Frontage, acres	10 acres	2,750	27,500
Handiways	2 each	4,000	8,000
Offices, 3 AC, 4 ERU/ac	12 offices	350	4,200
Five ac parcel, E/side SR 200	15 ERUs	350	5,250
		Subtotal Demand, gpd	*162,488*

SUMMARY - Development Option B

	AADF	MMF	MDF
Current Service Demand	83,879	129,600	181,000
Additional, Build out Existing Serviced Area	43,216	66,773	93,255
Future Addition	162,488	251,059	350,630
Total	**289,583**	**447,431**	**624,885**

Peak Hour and Irrigation Demand

Instantaneous peak hour demands consist of ordinary domestic demand in normal weather and irrigation demand on the maximum day during dry weather.

Estimated peak hour and irrigation system demands under both scenarios are as follows:

Option A

Instantaneous Demands	
AADF, gpm	216
Peak Demand	3.00
Peak Hour GPM	**647**
Max Day Demand	466
Irrigation	
% on	13.5
No of Lots	923
gpm each	8
Flow, gpm	997
Irrgation Instant	
Demand, gpm	**1462**

Option B

Instantaneous Demands	
AADF, gpm	201
Peak Demand	3.00
Peak Hour GPM	**603**
Max Day Demand	434
Irrigation	
% on	13.5
No of Lots	833
gpm each	8
Flow	900
Irrigation Instant	
Demand, gpm	**1334**

Fire Flow Demand, Option A

The current utility and water plant is not designed to provide fire flow, but is considering developing fire flow under this option.

The term "fire flow" refers to the quantity of water required in gallons per minute and in gallons of storage to fight a fire as determined from one of several different standards. In Marion County, there are several standards in use, one from the Utilities Department, and one of several from the Fire Marshal's office, that generate a fair amount of confusion. In addition, it appears likely that the Fire Flow requirements of the Marion County Utilities Department are likely to undergo significant change over the next several months.

The fire flow capacity that would be required of County - Wide Utility at Bahia Oaks is the largest capacity that would be required of a developer of property who is not exempt from the County fire flow requirements seeking to obtain fire flow from the Utility.

For a development project with up to peak demands of 1500 gallons per minute of domestic domand, the maximum required fire flow is 2,500 gallons per minute.

Looking at the entire utility, future peak domestic demand (not counting irrigation load) is estimated to be 647 gallons per minute. If the entire utility were considered as a new development having to meet Marion County Utility Department fire flow requirements, then the utility would be expected to have a fire flow capacity of 1,750 gallons per minute.

Based on the projected kinds of development under Option A, it is possible to obtain preliminary estimates of what fire flows could be required of individual projects:

Description	Peak Flow	Fire Flow
Area comprising blocks 25-27, parts 28-30 residential units	85.5	500
Multifamily, parts of blocks 28-30,21,22,32,24 residential units (assume 8 units/ac)	175	750
Department Store, 100000 sf	26.6	1000
Commercial Frontage, acres	4.9	1000
Grocery Store	17.1	1000
Restaurants, 2 at 120 seats each	19	1000
Handiways	2.7	1000
Offices, 3 AC, 4 ERU/ac	8.4	1000
Five ac parcel, E/side SR 200	10.5	1000

Other standards however may be applied owing to the somewhat confusing nature of overlapping jurisdiction between the Fire Marshal's office, the Marion County Utilities department, as well as the variable characteristics of future individual projects whose building contents and possible fire rating can only be conjectured at this stage.

For planing purposes at this stage, it is suggested that a design fire flow capacity of 1,750 gallons per minute be selected, and the conceptual design of the water plant allow for relatively simple expansion by addition of high service pumping and fire flow storage tankage to accomodate developers with exceptional fire flow requirements.

Rate of Growth Projections

There are several methods for projecting the rate of growth in demand. The two most common methods are growth based on historical trends (linear regression) and usage of site specific information concerning development timetables.

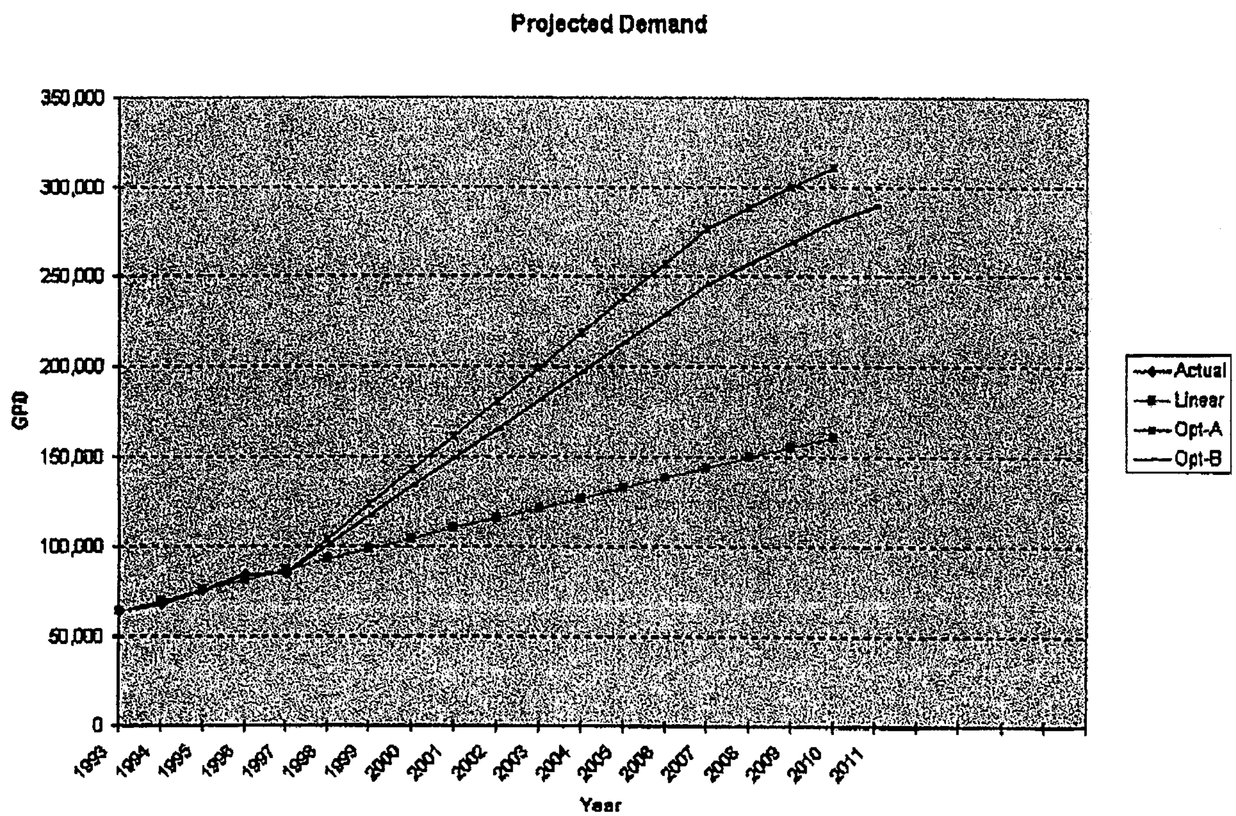
In this case, both linear regression and site specific knowledge was used.

Historical data from 1993 was obtained from the Owner and from SWFWMD and a linear regression performed of the data to ascertain trends.

The Owner however has indicated that residential growth in the future will be driven by expected lot sales, at the rate of 50 per year.

Commercial development will be expected to build out over a 10 year period.

In the graph below, linear growth, growth expected under development option A and option B, is compared.



Projected Demand			*Opt-A*	*Opt-A*	*Total*	*Opt-B*	*Opt-B*	*Total*
Year	*Actual*	*Linear*	*Residential*	*Commercial*	*Opt-A*	*Residential*	*Commercial*	*Opt-B*
1993	64,252	63,990						
1994	67,997	69,683						
1995	75,909	75,376						
1996	84,016	81,069						
1997	84,707	86,762	84,707		84,707	84,707		84,707
1998		92,455	96,307	7,600	103,907	96,307	4,495	100,802
1999		98,148	107,907	15,200	123,107	107,907	8,990	116,897
2000		103,841	119,507	22,800	142,307	119,507	13,485	132,992
2001		109,534	131,107	30,400	161,507	131,107	17,980	149,087
2002		115,226	142,707	38,000	180,707	142,707	22,475	165,182
2003		120,919	154,307	45,600	199,907	154,307	26,970	181,277
2004		126,612	165,907	53,200	219,107	165,907	31,465	197,372
2005		132,305	177,507	60,800	238,307	177,507	35,960	213,467
2006		137,998	189,107	68,400	257,507	189,107	40,455	229,562
2007		143,691	200,707	76,000	276,707	200,707	44,950	245,657
2008		149,384	212,307		288,307	212,307		257,257
2009		155,077	223,907		299,907	223,907		268,857
2010		160,770	234,641		310,641	235,507		280,457
2011						244,633		289,583

Capacity Analysis Existing Water Plant

The capacity of the existing water supply plant can be expressed in terms of its:

- capacity as reflected in FDEP records
- capacity in terms of its allowable ground water withdrawal quantity permitted in its Water Use Permit
- the actual physical through put capacity of its components

FDEP Permit

FDEP has assigned Public Water System ID number 6420103 to this facility. FDEP records indicate that the facility has a capacity of 720,000 gallons per day to serve a population of 500 persons.

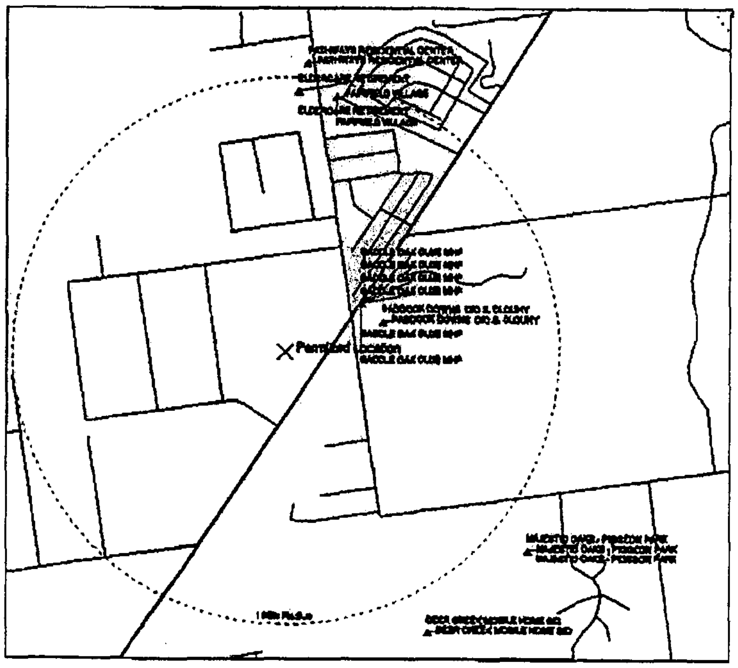
Water Use Permit

The current water use permit is number 203239.01, due to expire November 18, 2004.

Current annual average permitted capacity is 201,000 gpd, with a maximum monthly average withdrawal of 292,000 gpd.

The water use permit allows operation of (2) 6 inch wells and allows the Utility to apply for a well construction permit for a 10 inch fire flow well with maximum withdrawals of 1,000 gpd average, 12,000 gpd peak month.

The location of the fire flow well as permitted by latitude and longitude coordinates is shown at right:



Water Plant Physical Capacity

The existing water plant is a simple system consisting of two wells, a hydropnuematic tank, and a hypochlorination system. The pumps in the wells deliver water to the system and maintain system pressure.

Water Wells

The two wells are reported to contain 20 Hp each sta-rite submersible water pumps. Test reports of each well shows that the north well operates in a range of 219 to 283 gallons per minute. The south well operates in a range of 228 to 295 gallons per minute.

The maximum 24 hour capacity of one of the wells, based on an average pumping rate of 250 gallons per minute, would be 360,000 gallons per day.

To assign a capacity to the wells, it is necessary to consider the following FDEP rules and issues:

> **Rule 62-555.315 (1)** " Number of wells required - A minimum of two drinking water supply wells shall be provided for all community water systems that will serve 350 or more persons or have more than 150 connections"
>
> **Rule 62-555.320 (7)** "High Service Pumps - High service pumping and distribution facilities shall be designed to provide maximum hourly system demand without either development of a distribution pressure lower than 20 psi or other health hazards. Elevated storage with appropriate hydraulic characteristics may be combined with service pumping units or distribution components to meet system demand."

In the instant case, the high service pumping system is in fact the pump in each well. The issue then is whether or not one well (and pump) could maintain 20 psi in the system with one well out of service. (It should also be considered that customer complaints are likely below system pressures of 35 psi).

Referring to the pump curves, one pump can produce 228 gallons per minute at 240 feet total dynamic head. One pump can produce more volume, but at much lower total dynamic head. As the head decreases, so does the system operating pressure.

Thus one submersible water well pump operating at an average of 250 gallons per minute should be able to maintain system pressure during the maximum hour. However, since the maximum hour flow is probably three times the average daily demand, the corresponding average *daily* flow would be 1/3 * 250 *1440 = 120,000 gpd.

If we factor in irrigation demand, currently estimated to be about 391 gallons per minute then it is likely that both well pumps have to operate to meet the demand. While occasional demands which might require both pumps is not a significant concern, regular, recurrent demands that have to be met by more than one pump probably would draw system pressures below 20 psi if one well (and pump) went out of service.

Chlorination System

The existing chlorination system uses hypochlorination. According to rule 62-555, hypochlorination may be used up until an equivalent theoretical gas chlorination demand per day exceeds 10 #/day.

The amount of gas chlorination required to achieve a satisfactory residual depends on several factors such as raw water pH. However, assuming a dose of 6 mg/L, then gas chlorination is required above 200,000 gpd. By contrast, if satsifactory chlorine residuals and system disinfection is being maintained with a dose of 2 mg/L, then gas chlorination would not be required until demand exceeded 600,000 gallons per day.

Hydropnuematic Tank

The existing hydropneumatic has a nominal capacity of 5000 gallons. The tank is used for both chlorine contact time as well as to maintain system pressure when the water system pumps are not operating,

The effective volume for chlorine contact time is the water volume, about 70% of the nominal tank volume.

Fifteen minutes at peak hourly demand are normally assumed adequate for complete disinfection. FDEP requires 15 minutes chlorine contact time in some facilities based on water quality. At this facility this corresponds to a flow rate of 233 gallons per minute

Hydropneumatic tanks are also used for pump control purposes, and at present on a maximum day would cycle 7 times per hour during non peak demand hours. Current set points are 62 psi off, 42 psi lead pump on, and 38 psi second pump on.

Based on the foregoing, the hydropneumatic tank is probably adequate for the flow rate it currently experiences. A larger tank would be desirable for higher flow rates.

Standby Power

Standby power is required by rule 62-555 for all system serving more than 350 people or having more than 150 service connections. The existing plant has one standby generator able to operate one well, of 75 kw capacity..

Capacity of Existing Water Distribution System

The capacity of the exisitng water distribution system was assessed by assembling a computer model of the distribution system. The model used is the EPANET water distribution system analysis program. The system was mapped in AutoCAD and the hydraulic model text data was stored as attributes of AutoCAD block elements representing system hydraulics in the drawing. This data was then extracted and formatted for input into EPANET. Data extraction can be performed using standard AutoCAD commands and a text editor , however, in this case, McDonald Group International's Water Transport LT was used to automate the process.

Hydraulic models in general represent distribution systems as a collection of pipes, which have properties of length, diameter, and friction co-efficient, linking up and downstream "nodes" which have properties of elevation and demand. Other elements represent system controls such as pumps, supply sources, and control valves.

In this case the supply source is groundwater, and is represented in the model as a tank with a hydraulic grade corresponding to the elevation of the groundwater. The well pumps which withdraw the water are modelled as a single pump. Different pump curves are used depending on whether it is desired to simulate both pumps in operation or one pump in operation.

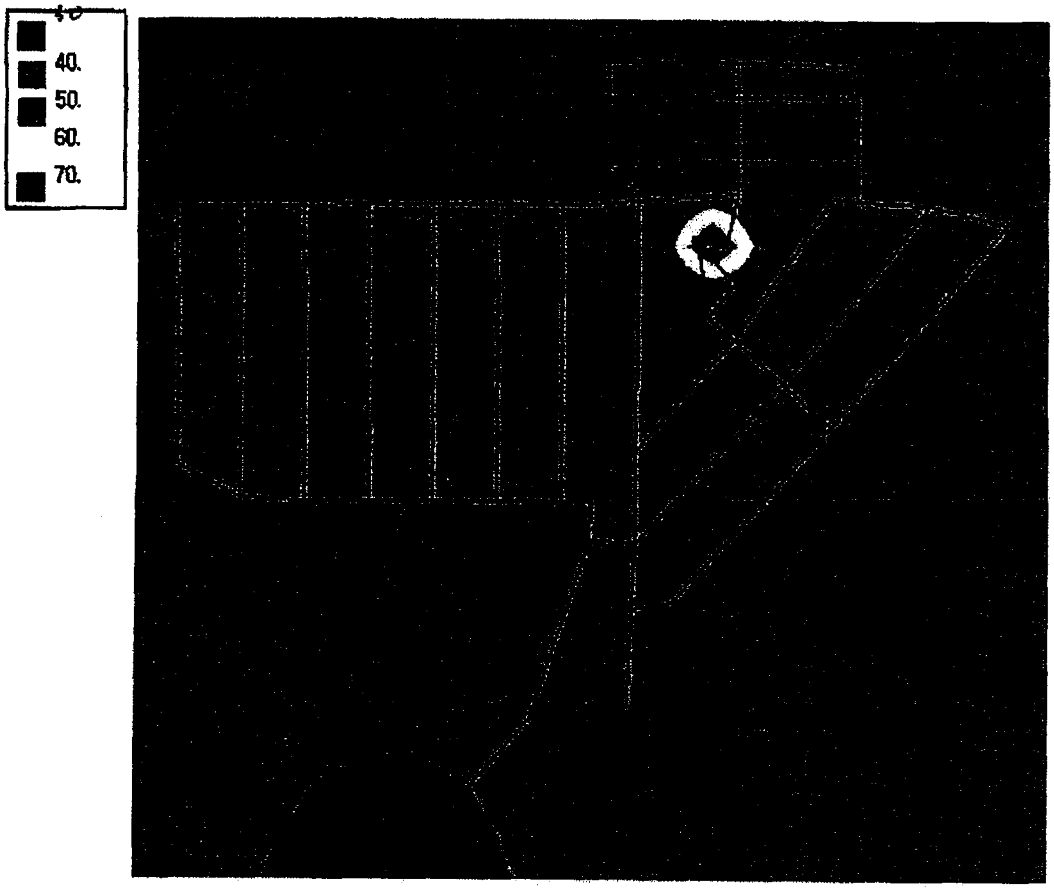
Overall system demand is distributed reasonably uniformly among the nodes, adjusting for higher demand levels in the newer section and lower demands in the older section.

The hydropnuematic tank is simulated as a tank with a pressure reducing valve, which limits downstream pressures to the setpoints of the tank. At low demand, this allows the model to represent the way the effect the tank has on downstream pressures, as a pressure reducing mechanism. At high flows, it allows the model to represent the limits of the supply pump.

Several "steady state" simulations were then performed. A "steady state" simulation is a instantaneous "snapshot" of the distribution system under one set of conditions.

Peak Demand, One Pump In Operation, Plant at 50 psi

Under this condition, the model is loaded at a demand of 175 gallons per minute, with the water plant approximately midway betwen its on and off cycle.

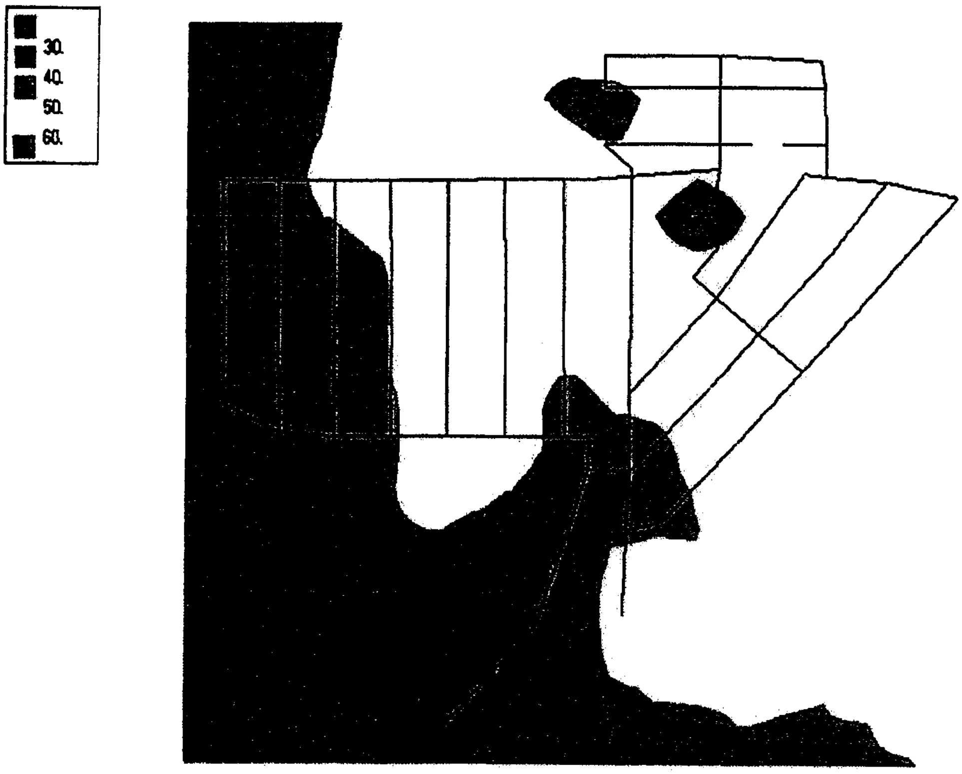


Pressure in existing distribution system under ordinary peak demand, (non irrigation demand), one pump in operation and with tank outlet pressures set at 50 psi. Higher pressures shown at water plant are upstream of the tank and indicate tank is filling.

Under this condition, the analysis shows that the system maintains a reasonable pressure. Lower pressures occur out at the convenience food store.

Existing System Under Irrigation Demand

The figure below shows the existing system pressures when operating under an irrigation demand.



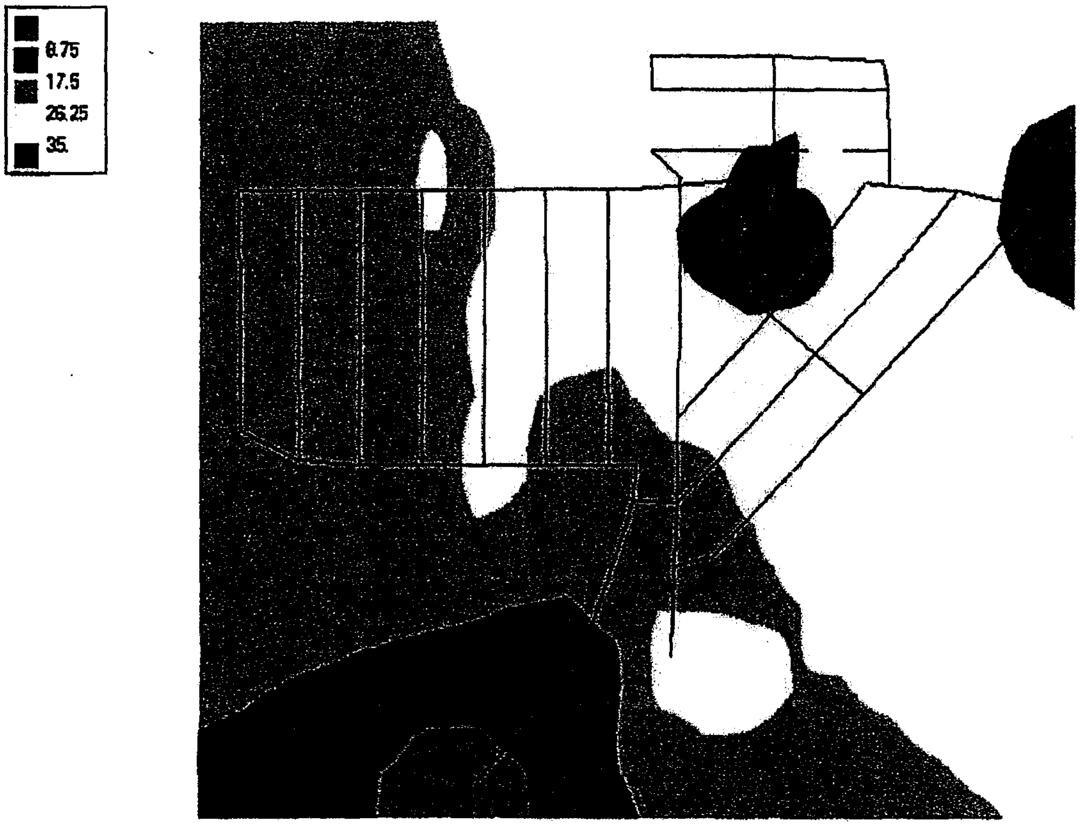
Current Conditions, Irrigation Demand, Both Pumps Running, Tank Pressure 50 psi

Under this test scenario, irrigation demand is uniformly distributed through the system, both pumps are assumed operating, and tank outlet pressure is at least 50 psi.

Under this scenario, this system shows acceptable pressures, but there is a caveat. The lowest pressure range for both pumps running is 38 psi. So even though most areas will show pressure in the 40 to 50 pound range under this range, at the moment both pumps commence operation, system pressures will actually be 22 psi less. This means that in a number of areas, system pressure may be near 20 psi. This pressure would remain at that level until the hydropneumatic tank fills and tank pressures approach 60 psi.

Existing System, Build Out, Irrigation Demand

In the figure below, system pressures are shown as the existing system builds out under an irrigation demand.

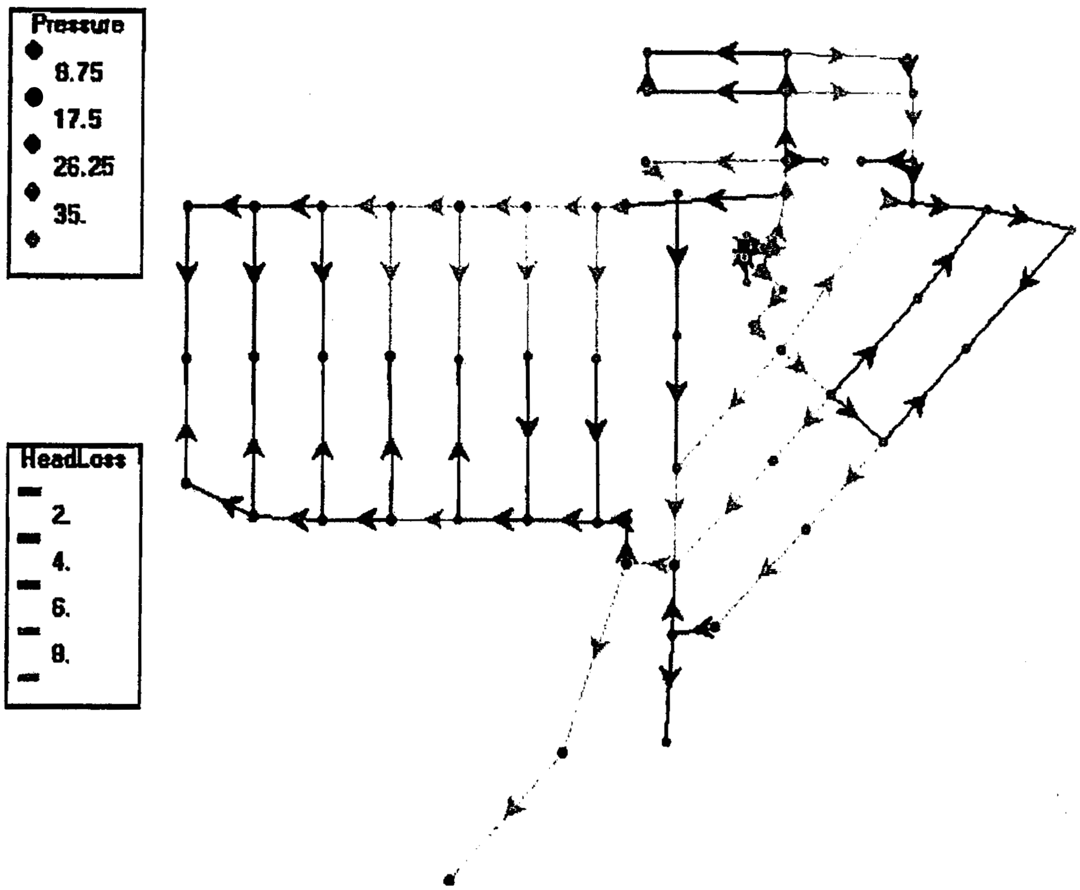


Existing System, BuildOut Conditions, Irrigation Demand, Both Pumps on, PRV set to 70 psi (note, system cannot achieve 70 psi under this demand

In this case, system head losses in piping become more noticeable. In addition, as the demand (over 700 gpm) is in excess of what can be supplied at a higher operating pressure by the pumps, the pumps will be operating at the far right end of their operating curve, delivering volume but not pressure.

The analysis above shows that system demand in the near future as more lots are sold in the newer area will likely severely reduce system pressures during peak irrigation demand periods.

Piping head loss is also more of a factor for this loading. The figure below shows where the piping losses in the system are:

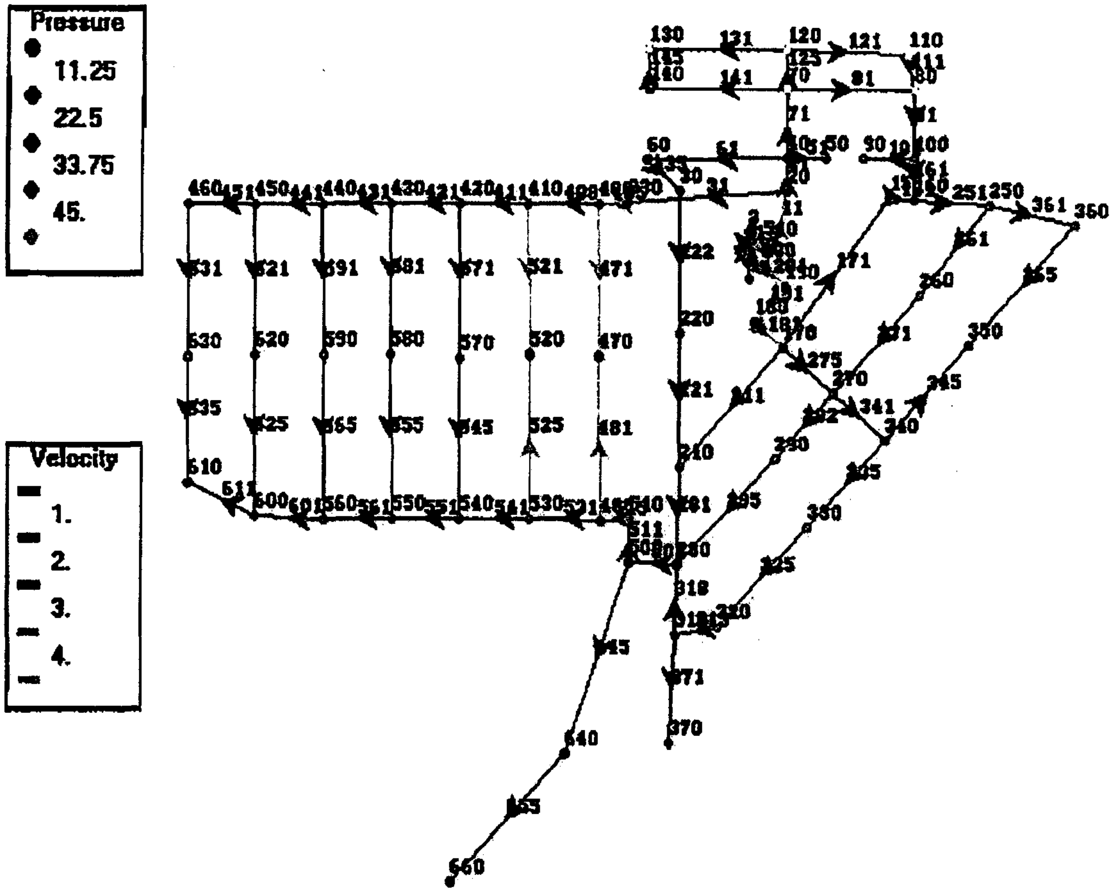


Pressure and Head Loss, Future Irrigation Conditions, Existing System at BuildOut

Existing System, Clustered Irrigation

A final analysis was made to determine what the system response would be when irrigation demand from several homes clusters on some of the two inch piping in the newer sections, under a peak demand condition at the low end of the pressure operating cycle.

In this case, it shows that pressures of about 30 psi occur at the two nodes (470 and 520) selected for analysis.



Current Conditions, peak demand with cluster irrigation at nodes 470 and 520, tank pressure at 40 psi

Note that there are relatively high velocities in the northern end of the two mains supplying these nodes. The corresponding pressure loss in each main is about 11 psi.

Summary - Analysis of Existing Distribution System

Under normal peak demand conditions, the existing supply and distribution system is probably able to meet system demands. As irrigation usage is factored in, problems become apparrent.

During periods of heavy irrigation usage, head losses begin to effect the system in the 4 inch piping near the water plant and in certain mains supplying the existing system. Cluster irrigation demands may cause high velocities and head losses in some of the 2 inch piping.

As the existing system grows towards buildout, demands are likely to exceed the capacity of the water plant even with both pumps running, which will result in system pressures near 20 psi.

Should one pump go down, then system pressures would fall below 20 psi under these conditions.

Florida Department of Environmental Protection rules do not speak very clearly on this particular situation. The rules state as follows:

> **Rule 62-555.315 (1)** " Number of wells required - A minimum of two drinking water supply wells shall be provided for all community water systems that will serve 350 or more persons or have more than 150 connections"
>
> **Rule 62-555.320 (7)** "High Service Pumps - High service pumping and distribution facilities shall be designed to provide maximum hourly system demand without either development of a distribution pressure lower than 20 psi or other health hazards. Elevated storage with appropriate hydraulic characteristics may be combined with service pumping units or distribution components to meet system demand."

Discussions with FDEP officials in Tampa indicate that the way the rule is interpreted is that in all cases two wells are required and system pressure must be maintained above 20 psi. This can be accomplished with two wells which provide system pressure and volume with one well backing the other up. If both wells are required to regularly operate together to meet system demand and pressure, then either a third well or additional system storage and pumping is needed.

Enforcement of these requirements can occur through site inspections or at a time when a permit is submitted to expand the distribution system. It is possible that if FDEP records indicate adequate system capacity exists in terms of gallons per day and there have been no pressure complaints, permits might be issued without questions. It is also possible that if FDEP has doubts about the ability of the system to maintain pressure, they might withhold issuing distribution permits pending review of an analysis of the capacity of the distribution system to meet demand, including the case where one well is out of service.

It is important to note that pressure complaints are likely when system pressures fall below 35 psi. In addition, the hydraulic model predicts system pressure up to the customer's service connection. When plumbing and meter losses are factored in, actual customer pressure can be 7 to 15 psi lower than the main pressure.

Water System Improvement Alternatives

The following alternatives were suggested for investigation at the beginning of this master plan study to ascertain the most appropriate course of action in upgrading the utility to meet projected demands under the alternative development scenarios:

Alternative One - Upgrade the water system (plant and distribution facilities) to handle the projected domestic demand from a predominantly residential development forecasted under development option B.

This alternative looks at the facilities needeed to provide 289,583 gallons per day annual average flow basis, 624,885 gallons per day on a maximum day basis, and up to 1334 gallons per minute instantaneous demand (peak flow plus irrigation demand).

Alternative Two/A - Upgrade the water system (plant and distribution facilities) to provide fire flow for the development conditions forecasted under development option A.

This alternative looks at what facilities are needed to provide 310,641 gallons per day annual average basis, 670,325 gallons per day on a maximum day basis, and 1,409 gallons per minute on a peak demand plus irrigation usage basis. In addition a fire flow capacity to serve the new commercial and residential sections of 1,750 gallons per minute is to be provided.

Alternative Two/B - Determine the feasibility of constructing an interim fire flow storage tank and minor piping upgrades to meet the fire flow requirements of the new commercial area, and determine how long this alternative will be of benefit to the system before its utility is exhausted.

This alternative assumes that the existing distribution system can be upgrades with minor line size increases in areas of high headloss, and coupled with a ground storage tank, primarily for fire flow purposes, may be of some benefit to the system for a period of time before increasing demand overwhelms the current production capacity.

Alternatives Three A and Three B - Determine the feasibility of purchasing bulk water from either Windstream Utilities or City of Ocala. Determine if either source or both can supply the demand needed when coupled with the existing system

Alternative One

Upgrade the water system (plant and distribution facilities) to handle the projected domestic demand from a predominantly residential development forecasted under development option B.

This alternative looks at the facilities needeed to provide 289,583 gallons per day annual average flow basis, 624,885 gallons per day on a maximum day basis, and up to 1334 gallons per minute instantaneous demand (peak flow plus irrigation demand).

The supply capacity of the existing water plant should be limited to 120,000 gpd, which therefore requires 169,583 gallons per day from a new water source.

The existing hydropneumatic tank is of marginal physical condition. As noted earlier, it is probably adequately sized for current conditions for pump control and for providing chlorine contact time to assure complete disinfection, but it is probably at maximum capacity.

The following upgrades are suggested by these constraints:

- increase hydropnuematic storage capacity at the existing well site
- develop the second permitted well, and install the necessary hydropneumatic tankage and equipment to provide a second water plant

To determine the relative contributions of both water plants to the system, and to determine the necessary pipe sizes, the distribution system in the future residential area was modelled with a new water plant operating in conjunction with the existing water plant. The new water plant was provided with a hypothetical pump capable of producing at least 1034 gpm, leaving the existing to produce 300 gallons per minute

Based on that criteria, the existing water plant would require replacing the existing 5000 gallon tank with a 7500 gallon tank.. This would provide 15 minutes chlorine contact time at 300 gpm and limit the number of pump starts per hour to an average of 4.

In the interest of keeping the new water plant simple, the well would use either a submersible or vertical turbine pump discharging into a hydropnuematic tank.

The pump will probably require a 75 hp motor. The total hydropneumatic tank size would need to be 24,000 gallons, possibly using (2) 12, 000 gallons tanks.

Based on anticipated average demand, use of hypochlorination would be an acceptable means of disinfection.

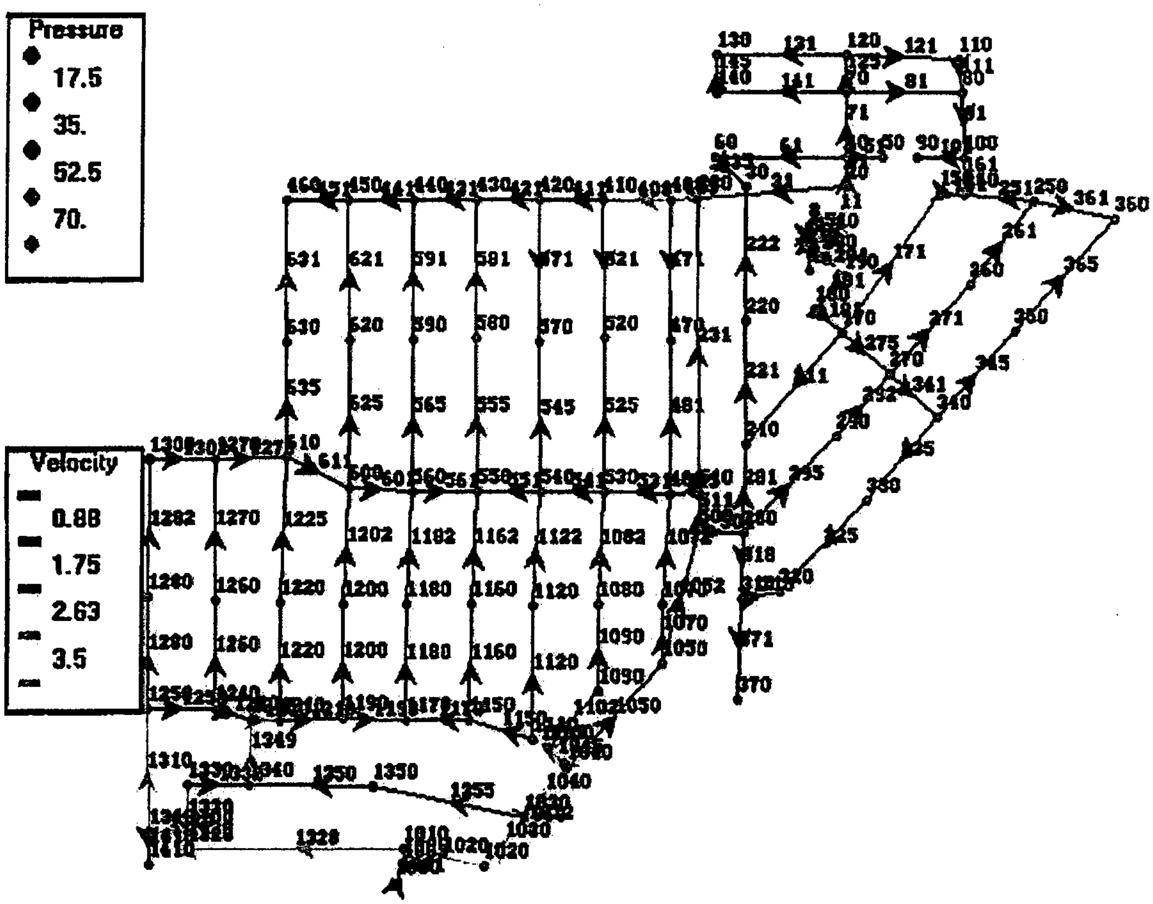
It will probably be difficult to find a pump to fit the 10 inch well case proposed in the current water use permit. Since this well is for fire flow only under the current permit, the permit would need to be modified, so the case size should be increased to 12 inches.

Rule 62-555 requires the use of multiple wells for a system this size. With the new well out of service, the remaining two wells would be able to supply the 624,885 gpd required for the maximum day, but meeting the peak hour plus irrigation demand of 1,334 gallons per minute is not possible. Under such conditions pressures may drop to less than 20 psi.

Consideration should therefore be given to having a backup interconnect with another utility or to have a number four backup well drilled.

Note that the new well will have to meet a 200 foot setback from septic tanks. This means that some lots near the proposed new water plant would not be developable. One advantage of this approach is that it pushes the hydraulic load on the new plant and reduces the load on the existing plant and distribution system. No additional interconnects or upsizing of line from the existing water plant would be necessary.

The map below indicates system pressure and velocity in the mains when under the anticipated heavy irrigation demand:



Alternative One, Development Option B, Buildout, Peak Demand Plus Irrigation. Note a proposed 6" WM (pipe 231) on SW 60th Avenue is included. Direction of Flow is to North, Pipe carries 47 gpm. No significant increase in pressure results.

Standby power is required of all community systems serving more than 350 people or having more than 150 connections. The power should be sufficient to meet at least 50% of the demand. The new water plant should have a generator.

Alternative Two/A

Upgrade the water system (plant and distribution facilities) to provide fire flow for the development conditions forecasted under development option A.

This alternative looks at what facilities are needed to provide 310,641 gallons per day annual average basis, 670,325 gallons per day on a maximum day basis, and 1,409 gallons per minute on a peak demand plus irrigation usage basis. In addition a fire flow capacity to serve the new commercial and residential sections of 1,750 gallons per minute is to be provided

The system requirements to provide this level of service would entail the following:

- develop a new water well as in Alternative One
- provide main distribution line sizes sufficient for fire flow
- provide ground storage tank and hi service pumping system for fire flow delivery.

The supply capacity of the existing water plant should be limited to 120,000 gpd, which therefore requires that the new water plant produce 190,641 gallons per day (annual average).

On a maximum day, the new water plant would need to produce about 550,000 gpd. Allowing for some reserve, the pump rate out of the ground required for this during an 18 hour period is 510 gallons per minute.

Discharging into a ground storage tank, the Total Dynamic Head is less than what would be required for a pump that also maintains system pressure. Approximately 15 to 20 Hp would be needed.

The ground storage tank would need to be at least 300,000 gallons, based on Marion County LDC for fire flow.

The pumping system would consist of jockey pump designed to maintain system pressure during ordinary average demand flows from this water plant. The pump capacity would need to be 132 gallons per minute , and probably about 7.5 Hp.

The hi service pumping system would consist of three pumps, each capable of supplying 1000 gallons per minute and would probably be at least about 40 Hp each. Additional pumps would come on line in response to system demand.

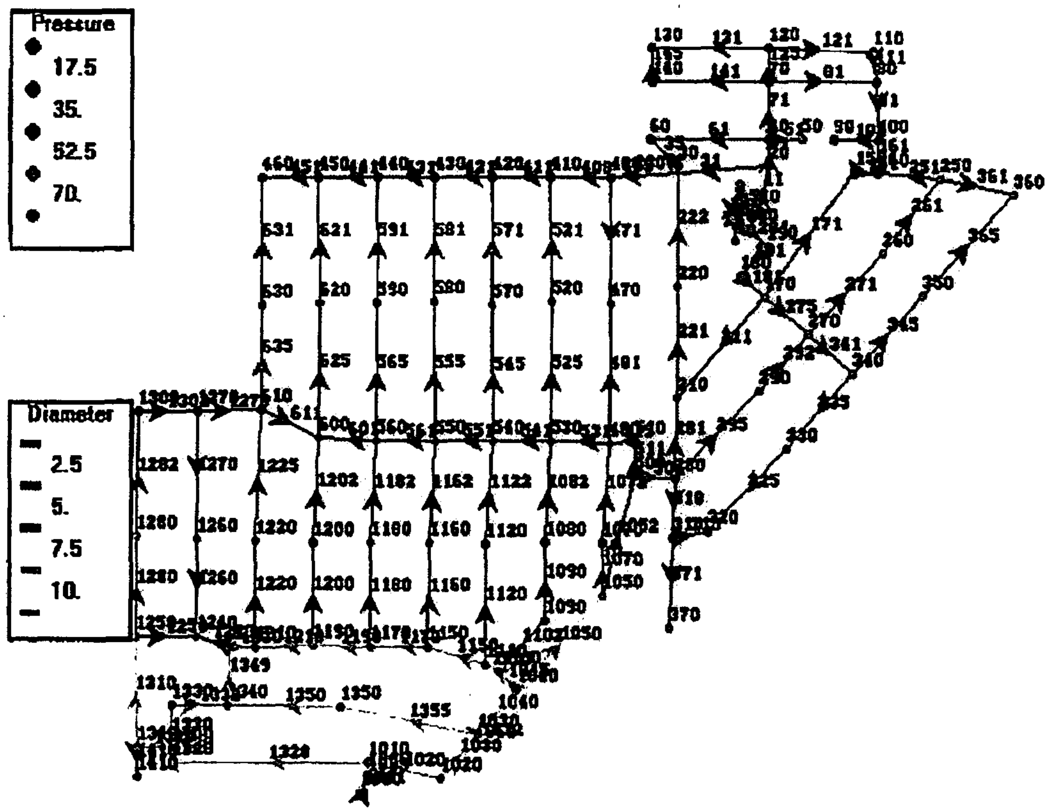
With the new well out of service, the remaining two wells running 24 hours per day would be able to supply the volume needed . Using the volume in the ground storage tank and the high service pumping system, peak hour demands could be met.

Standby power is required of all community systems serving more than 350 people or having more than 150 connections. The power should be sufficient to meet at least 50% of the demand. The new water plant should have a generator.

No final street layout or proposed water system layout was available to model, so the water distribution system represented under development option A has the same layout as option B. Demands were apportioned (Fire Flow, and peak demand) to load the system to conform with the characteristics of a preliminary land use plan, which favors heavy commercial development along SR200 and 60th Avenue, with multifamily existing between the commercial area and the single family residential to the North and West.

Significant changes are also required in the distribution system in order to be able to pass this quantity of water. Preliminary modelling suggests that the main feed from the water plant should be 12 inch with branches from 10 inches and 8 inches. In the residential portions of the new development area, most of the distribution lines would need to be 6 inches in order to be able to pass fire flow. In addition, in order to provide fire flow, the lines should be installed in the road right of ways rather than in the easements.

So configured, pressures and velocities in the system with a peak irrigation demand of 1409 gallons per minute and a fire load of 1000 gpm in the commercial area near SR 200 and a 750 gpm fire flow load in the residential area remain acceptable as shown below when three 1000 gpm high service pump are in operation.



1750 gpm fire flow + 1409 gpm irrigation demand, (3) 1000 gpm hi service pumps in operation, larger main sizes used in new developments

Alternative Two B

Determine the feasibility of constructing an interim fire flow storage tank and minor piping upgrades to meet the fire flow requirements of some portion of the commercial area, and determine how long this alternative will be of benefit to the system before its utility is exhausted.

This alternative assumes that the existing distribution system can be upgraded with minor line size increases in areas of high headloss, and coupled with a ground storage tank, primarily for fire flow purposes, may be of some benefit to the system for a period of time before increasing demand overwhelms the current production capacity.

This alternative is hydraulically equivalent to putting an elevated storage tank in the system, the idea being that water is stored during periods of low demand and is put into the system during periods of high demand.

The specific demand loading considered under this alternative is:

Desciption	Units	gpd/unit	extension
Current Demand			83,879
Commercial Frontage, acres	7	2,750	19,250
Restaurants, 2 at 120 seats each	240	75	18,000
Handiways	2	4,000	8,000
Offices, 3 AC, 4 ERU/ac	12	350	4,200
Five ac parcel, E/side SR 200	15	350	5,250
		Annual Average Demand, gpd	*138,579*
Maximum Month Demand, gpd			*213412*
Maximum Day Demand, gpd			*299026*
Peak Hour Demand, gpm			*289*
Irrigation and Max Day, gpm			*599*
Largest Fire Flow			*1000*

The 24 hour pumping capacity of one existing well at 250 gallons per minute is 360,000 gallons per day. This would be sufficient to meet the anticipated development requirements on an annual average basis. One well would not be able to meet peak demand without a hi service pumping system.

The size of the tank based on Marion County LDC should be at least 75,000 gallons in order to support a 1000 gallon per minute fire flow.

Because of space requirements, the tank should be located where the future water well has been permitted so it can be added if necessary.

The tank would be filled by a solenoid controlled valve. When the tank is empty and the hi service system is not pumping, the storage tank would fill with the valve open. When the tank was full or the hi service pumps were in operation, the valve would shut. The valve would also be a pressure sustaining valve on the inflow side, so that it would not open so wide so that system pressures could be reduced during the fill cycle.

The pumps would turn on and off in response to system demand.

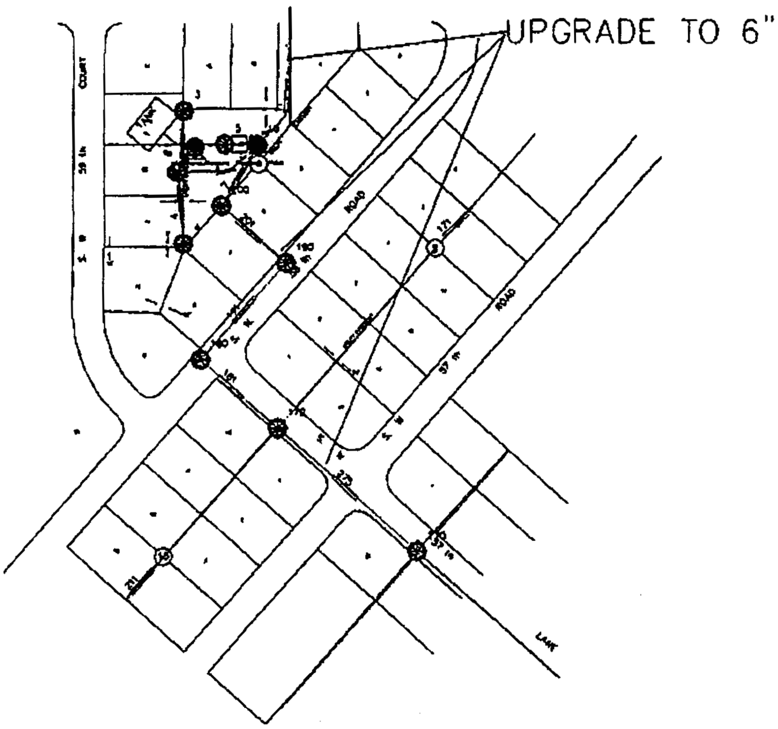
As in some other options, one low flow jockey pump and two 500 gpm pumps are desirable, with provision to add a fourth pump in the future or to increase pump capacity by impeller change or other simple method.

In the distribution system, upgrades would be needed to the 4 inch piping serving the existing water plant so that excessive headlosses in the system piping would not be felt when the plant was producing 250 gallons per minute.

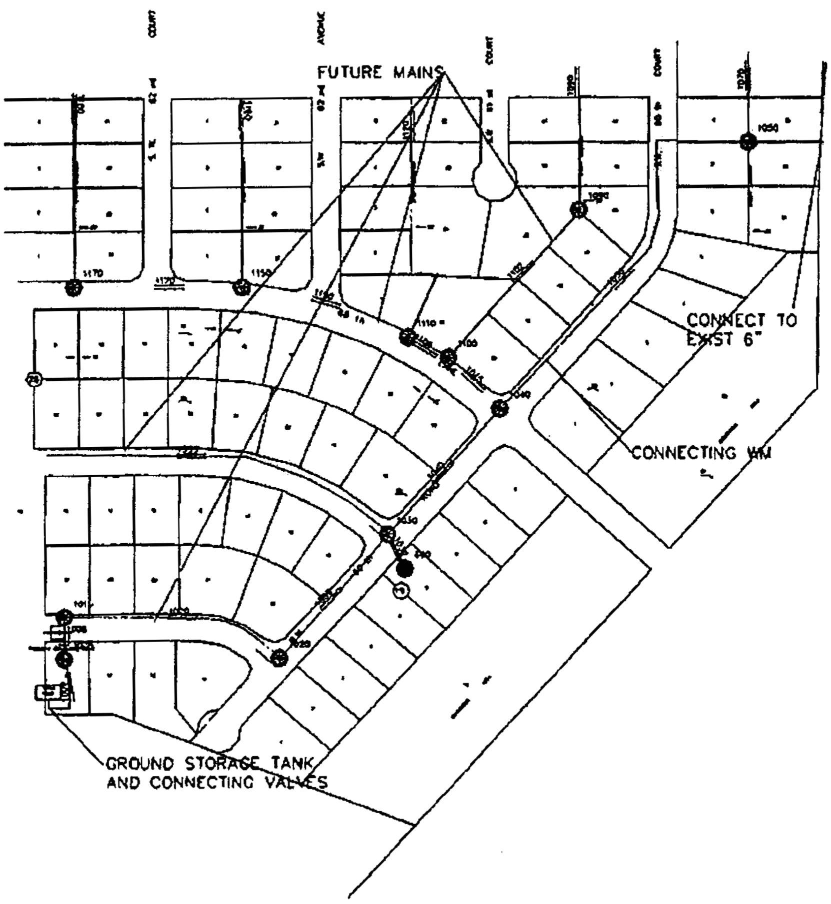
Owing to the condition of the existing hydropneumatic tank, it would need to be replaced, and a larger tank (7500 gallons) should be used..

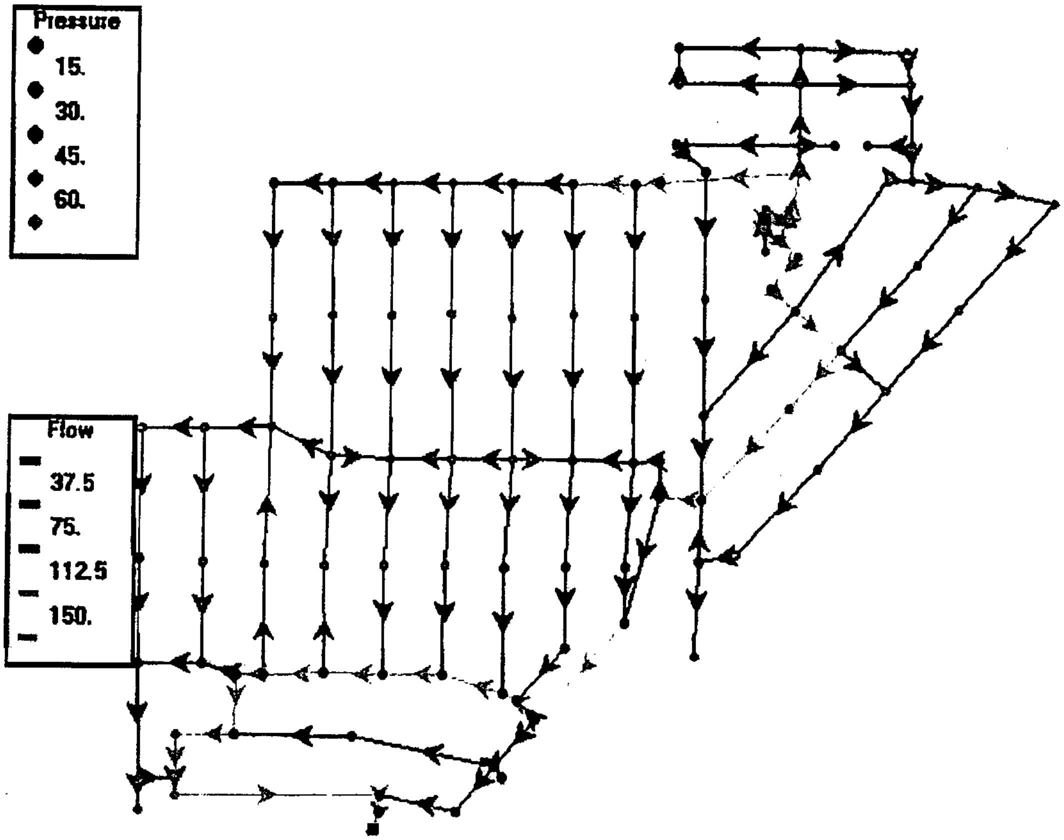
The availability of storage in the system and a separate high service pumping system would extend the overall capacity of the water plant.

This would allow the overall water supply system to be rated between 200,000 and 300,000 gallons per day, which is the forecasted annual average demand after 2003.



Water main upgrades needed near existing water plant if no new water supply source is connected to the system





Predicted System Flows and Pressure when existing water plant is filling a ground storage tank with system pressure maintained by a pressure sustaining valve

Alternative Three A and Three B *Determine the feasibility of purchasing bulk water from either Windstream Utilities or City of Ocala. Determine if either source or both can supply the demand needed under either development scenarios when coupled with the existing system*

ThreeA - Windstream Utilities

Currently Windstream Utilties has an annual average day demand of about 212,00 gpd.

Its current water user permit allows to withdraw 280,000 gpd on an annual average basis. Windstream Utilities is expecting approval from the SWFWMD to increase its water usage to 632,000 gpd annual average basis.

At present, the physical components in place consist of two 650 gpm wells. Sufficient hydropneumatic tankage is in place to provide adequate chlorine contact time for 467 gallons per minute. FDEP recently provided approval to add a second hydropneumatic tank to increase the maximum thruput capacity of the plant to 1,400 gallons per minute.

Under development Option One, Windstream Utilities would need to supply 170,000 gallons per day (annual basis) and up to 1000 gallons per minute to meet the project demand (as in Alternative One).

While it appears that Windstream will in the near future have adequate capacity to supplement the Bahia Oaks system, that capacity will be utilized over time by development within Windstream Utilities PSC Certificated area.

In fact, over ten years, all of the capacity that is being generated by planned improvements would be utilized by Windstream for its own service area (ref: SWFWMD WUP permit application).

In 2004, (six years from now) expected demand within Bahia Oaks will be 219,000 gallons per day under development Option A and 197,000 gallons per day development Option B.

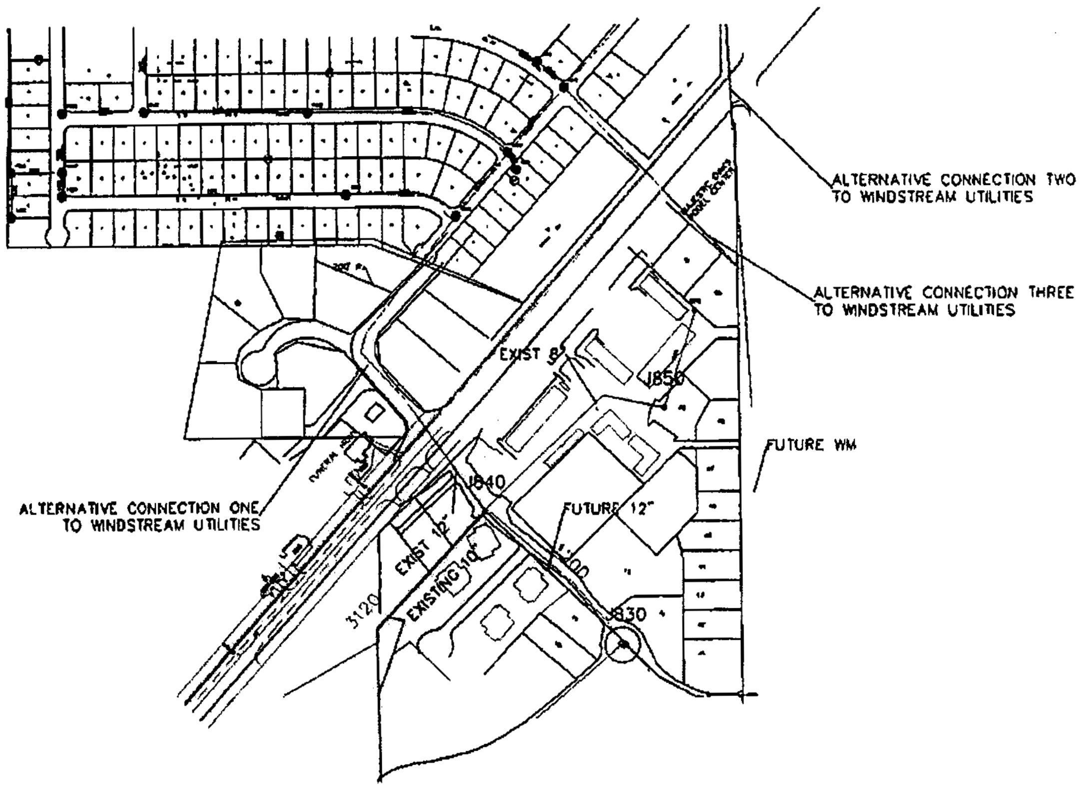
At that time, Windstream Utilities is expected to be consuming 508,500 gallons per day (ref: SWFWMD WUP permit application). It also would likely be trying to provide up to 1060 gallons per minute during peak times to its own service area. Under its projected Water Use Permit, this means that 123,500 gallons per day would theoretically be available for Bahia Oaks.

As a consequence, it can be concluded that connecting to Windstream Utilities would be feasible for a period of probably less than five years, during which time Windstream Utilities would need to upgrade its well pumps system in order to provide the capacity required to serve Bahia Oaks.

Total future demand in the Windstream Utilities Service area is 774,000 gpd (ref: SWFWMD WUP permit application). Combined with the demand from Bahia Oaks, total demand would be over 1 MGD. The existing wells at Windstream Utilities coupled with the supplement from Bahia Oaks would be sufficient to meet annual average demand.

To meet instantaneous demands however, Windsteam Utilites would need to install storage and hi service pumping facilities to produce over 3000 gpm (development option B) or roughly 5000 gpm under development option A.

The figure belows show three different ways the connection can be made and some of the issues involved:



Connection Alternative One would be practical and beneficial if the developer of the property shown were to build the development and install the line. Alternative Two is possible but is not as practical as Connection Alternative Three.

For costing purposes, alternative three was selected. Connection includes sleeving the pipe below SR 200, appropriate valves and a meter. Windstream Utilities would need to obtain an easement as shown but this may not be difficult.

Unfortunately, the primary feed from the Majestic Oaks water plant that serves this area is an 8 inch line. The ten and twelve inch lines shown in the figure above all tie back into it. To provide the water needed to serve Bahia Oaks as it builds out, that line would need to be upgraded.

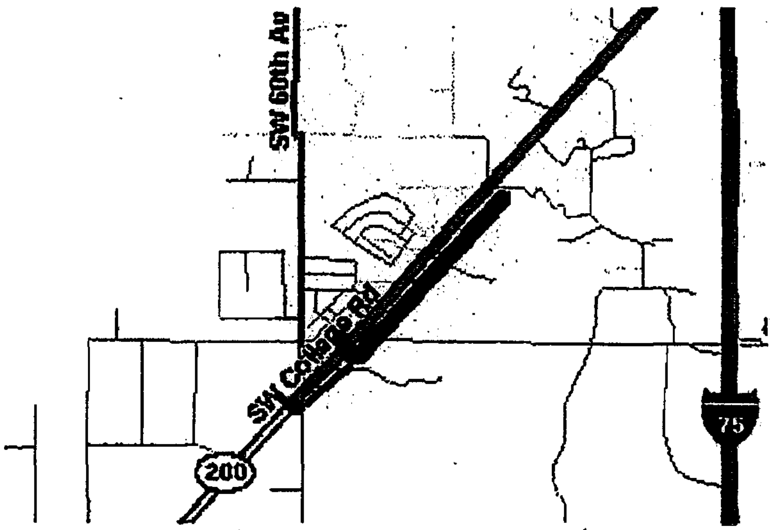
In terms of the line sizing that would need to be in place on the Bahia Oaks property, the points of connection are hydraulically the same as the water plant investigated under Alternative One and Two-A.

For costing purposes, costs have been estimated based on the amount of line that would be needed to tie the two water systems together today. One advantage of tieing to another utility is that it would eliminate the need for standby power.

Three B - Connect to City of Ocala

In this alternative, Bahia Oaks connects to the City of Ocala. The City reports that it has the capacity to serve the utility including fire flow, although very large quantities (several thousand gallons per minute) may require it to review the capacity of their system in greater detail.

The City's existing main ends at 50 th Ct and SR 200 on the South (or East) side of the road. The City may allow connection if County Wide Utility constructs the water main to City standards and agrees to turn the water main over to the City.



Proposed water line from City of Ocala system at 50th Ct and SR 200 to nearest point of connection at Bahia Oaks. Thin line shows possible future extension

There are number of issues involved that make this alternative difficult to ascertain if it is truly feasible or not.

First, the City has indicated it will not allow the connection unless the County agrees to it.

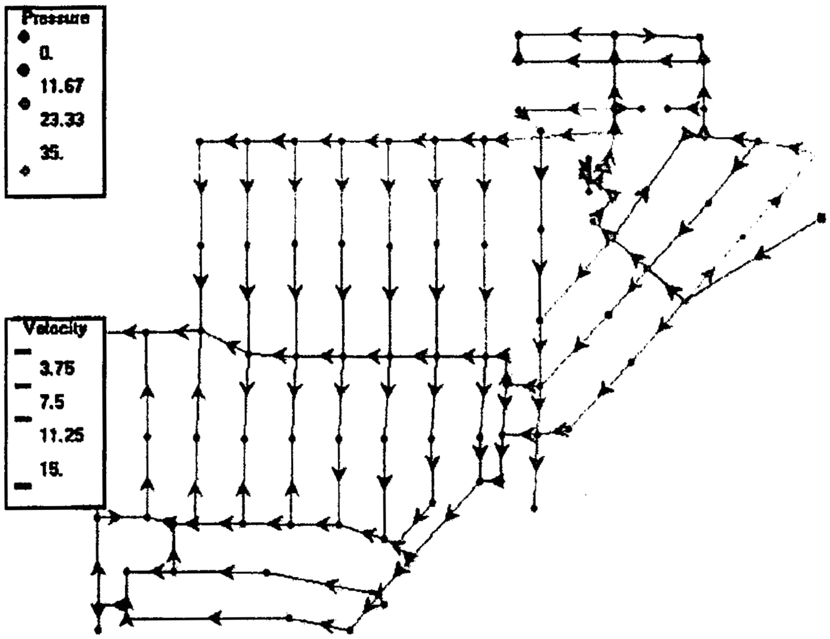
Second, the issue of how the water would be metered would need to be negotiated between the City Engineer and the Utility Engineer. The utility department has indicated that bulk water sales are being discouraged. Conversion of all the Bahia Oaks meters to City meters may be required. (cost of the City meter is $138 each).

Third impact fees may be calculated at $536 per conventional home and $509 per mobile home if a bulk water sale is not possible. If it is possible then impact fees may be calculated on the basis of the master meter size.

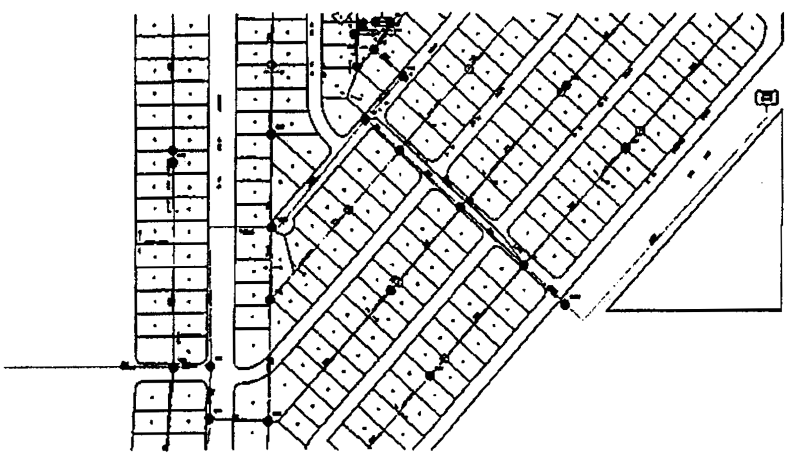
Fourth, an agreement to annex may be required should City limits someday become contiguous to property owned by the Utility in the future.

Fifth, the utility is responsible for construction of the line (how this would work against impact fees would need to be negotiated), it would become the property of the County, and it would have to be constructed to City standards, which includes the pipe being DIP Class 50, and a double check valve would be needed at the point of connection.

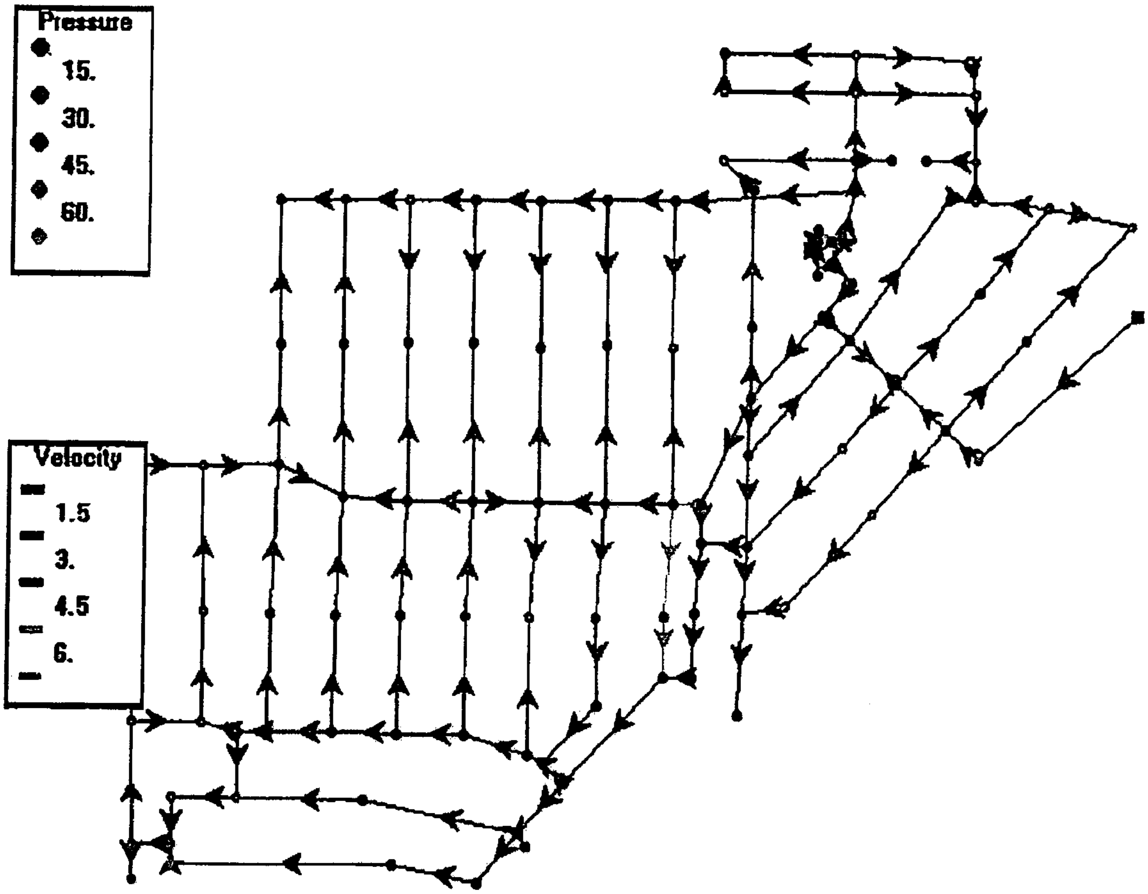
Several points of connection were tried. In the figure below, a connection up 57[th] Lane was tried with a 10 inch connection across 60[th] ave. Under development option B, at peak irrigation load, the system is unable to provide the pressure needed.



Another method of connecting the water system to the City of Ocala is to run a water main through Bahia Oaks to tie near the existing water plant and then out to SW 60[th] Avenue using ROW and easements. This would allow installation of fire hydrants within the older part of Bahia Oaks and allow the distribution of fire flow.

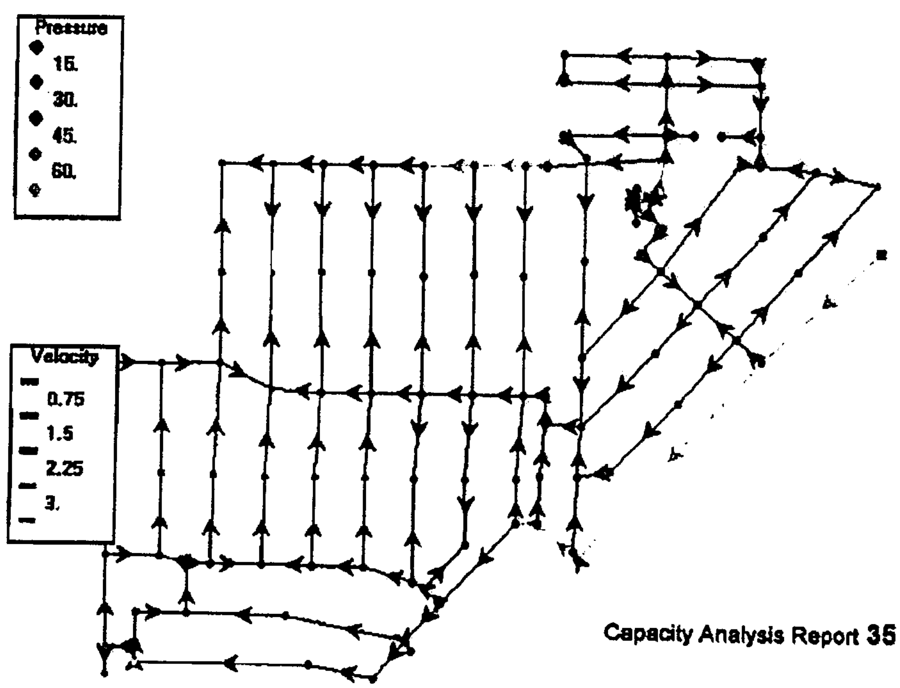


Connection to City of Ocala, with new 12 inch routed through Bahia Okas

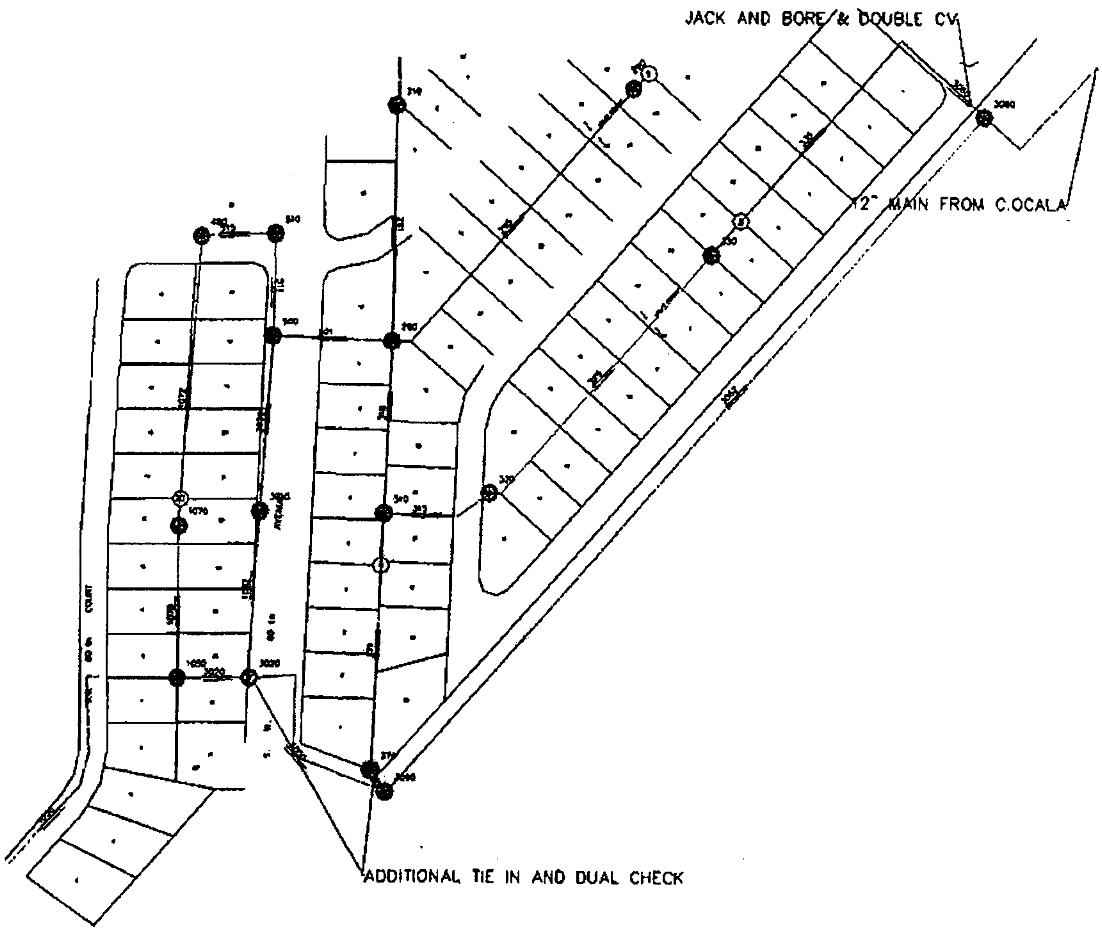


System pressures when connected to City of Ocala, using through subdivision 12 inch main

An alternate route is shown at the right, where the 12 inch water main is continued south along SR 200 and connect the proposed development on the west side of 60th avenue.



The actual points of connection are shown in the figure below:



Summary of Probable Improvement Costs

The table below summarizes the engineer's opinons of probable construction costs associated with each of the alternatives studied.

Alternative	Cost	Comments
One - New 12" Well, (2) 12,000 gallon tanks	$ 226,608	Handles Development Option B
Two - A New 10" Well, Ground Storage, Hi Service Pumps	$ 458,445	Provides fire flow, supplies Development Opt A
Two - B Storage Tank and Pumping System	$ 281,377	Sufficient Thru 2003
Three - A Connect to Windstream Utilities	$ 108,291	Not sufficient for long term w/o improvements to \ Other Costs not determined - see below
Three - B Connect to City of Ocala	$ 308,561	Other Costs not determined - see below
	$ 310,925	Optional Thru Subdivision Route

The above costs do not include the cost of land. The Owner of the utility has supplied a figure of $150,000 that should be added to each alternative that would require land for a second treatment plant and for adequate setback or buffer from neighboring properties. If this figure is included, the totals would be as follows:

Alternatives With Land Costs	Cost
One - New 12" Well, (2) 12,000 gallon tanks	$ 376,608
Two - A New 10" Well, Ground Storage, Hi Service Pumps	$ 608,445
Two - B Storage Tank and Pumping System	$ 431,377
Three - A Connect to Windstream Utilities	$ 108,291
Three - B Connect to City of Ocala	$ 308,561
(opt)	$ 310,925

Some comments:

With respect to alternative three A, although this looks like the lowest cost alternative, it must be remembered that while Windstream Utilities has some extra capacity now, that capacity will be utilized in the future by growth within the Windstream Utilities service area. In fact, in order to serve Bahia Oaks, a PSC amendment would likely be needed. As such there may be very significant connection/expansion fees/costs which would be negotiated between the utilities, and at present are of indeterminable value.

With respect to alternative three B, there are also undetermined costs with respect to connection fees owing to the uncertainty of whether or not the City would be willing or able to sell bulk water, so the actual cost of this alternative will be higher than as indicated once connection .

In Alternative Two B the entire supply for the Bahia Oaks development is intended to come from the existing wells. The system would be able to meet the needs of the service area using those wells and proposed storage system for one maximum day but would reach its maximum capacity, based on forecasted growth, by 2003.

Appendices

Opinions of Probable Cost per Alternative

Alternative One

Description	*cost*	
New 12" Well and Pump	$	45,000
(2)12,000 gal Hydropnuematic Tanks	$	48,788
Yard Piping	$	14,000
Chlorination System	$	3,000
Electrical	$	50,000
Testing	$	1,000
Control/Pump Building	$	15,000
Site Work	$	4,000
Engineering:		
Foundation Geotechnical	$	2,000
Civil/Mechanical	$	21,215
Permits		
FDEP and SWFWMD	$	4,000
Replace exsting tank w/7500 gal tank	$	18,605
Total	**$**	**226,608**
Current Number of Lots		489
Buildout Flow - Current Flow		205704
Number of ERUs at 350 gpd/each		588
Total ERUs		1077
Total Current ERUs		362
Total New ERUs		715
Cost per each new ERU	$	317

Alternative Two - A

Description	*cost*	
New 10 inch well and 15 Hp Pump	$	28,000
0.3 MGAL Storage Tank	$	125,000
Hi Service Pumping System	$	45,000
Yard Piping	$	60,000
Chlorination System	$	3,000
Electrical	$	85,000
Testing	$	1,000
Control/Pump Building	$	35,000
Site Work	$	6,000
Engineering:		
Foundation Geotechnical	$	2,000
Civil/Mechanical	$	45,840
Permits		
FDEP and SWFWMD	$	4,000
Existing Water Plant - replace tank	$	18,605
Total	**$**	**458,445**
Current Number of Lots		489
Buildout Flow - Current Flow		226762
Number of ERUs at 350 gpd/each		648
Total ERUs		1137
Total Current ERUs		362
Total New ERUs		775
Cost per each new ERU	$	592

Alternative 2B

Description	*cost*	
75,000 gal Storage Tank	$	80,000
Hi Service Pumping System	$	32,500
Yard Piping	$	60,000
Electrical Hi Service Pumps System	$	35,000
Testing	$	1,000
Control/Pump Building	n/a	
Site Work	$	6,000
Engineering:		
Foundation Geotechnical	$	2,000
Civil/Mechanical	$	20,472
Permits		
FDEP	$	3,000
Existing Water Plant - replace tank	$	18,605
Upgrade 1140 feet of 4" to 6"	$	22,800
Total	**$**	**281,377**
Current Number of Lots		489
Buildout Flow - Current Flow		205704
Number of ERUs at 350 gpd/each		588
Total ERUs		1077
Total Current ERUs		362
Total New ERUs		715
Cost per each new ERU	$	394

Alternative Three A

Description	*Unit Cost*	*Quantity*	*Extension*
On Bahia Oaks Property:			
12" PVC	$ 15	1262	$ 18,930
12" GV	$ 900	3	$ 2,700
8" GV	$ 700	1	$ 700
Sod	$ 3	449	$ 1,122
Seed and Mulch	$ 0.35	1795	$ 628
Meter and BackFlow Preventer, 12"	$ 25,000	1	$ 25,000
Off Site			
12" PVC	$ 15	1409	$ 21,135
18" sleeve (not jack and bored)	$ 50	104	$ 5,200
Sod	$ 3	464	$ 1,160
Seed and Mulch	$ 0.35	1856	$ 650
Other Costs			
Traffic Maintenance	$ 2,000	1	$ 2,000
General Restoration	$ 2,000	1	$ 2,000
Testing	$ 1,000	1	$ 1,000
Subtotal			$ 82,225
Engineering/Permitting	$ 8,022	1	$ 8,022
Existing Water Plant - replace tank	$ 18,045	1	$ 18,045
Total			**$ 108,291**

Current Number of Lots	489
Buildout Flow - Current Flow	205704
Number of ERUs at 350 gpd/each	588
Total ERUs	1077
Total Current ERUs	362
Total New ERUs	715
Cost per each new ERU	$ 152

Alternative 3B

Description	*Unit Cost*	*Quantity*	*Extension*
12" DI CLASS 50	$ 20	7774	$ 155,480
12" GV	$ 900	5	$ 4,500
6" GV	$ 700	2	$ 1,400
Sod	$ 2.50	2764	$ 6,910
Seed and Mulch	$ 0.35	11056	$ 3,870
Meter and BackFlow Preventer, 12"	$ 25,000	1	$ 25,000
Meter and Backflow Preventer, 6"	$ 11,000	1	$ 11,000
<u>Other Costs</u>			
Traffic Maintenance	$ 2,000	1	$ 5,000
General Restoration	$ 2,000	1	$ 4,000
Testing	$ 1,000	1	$ 1,000
Jack and Bore SR 200	$ 150	200	$ 30,000
Jack and Bore 60th Avenue	$ 150	130	$ 19,500
Subtotal			$ 267,660
Engineering/Permitting (8% of construction)	$ 22,856	1	$ 22,856
Existing Water Plant - replace tank	$ 18,045	1	$ 18,045
Total			**$ 308,561**
Option: Delete extension on SR 200, Route through Subdivision			
12" DI, Difference in Length	$ 20	-33	$ (660)
Road/Driveway Cuts	$ 18	168	$ 3,024
		subtotal	$ 310,925

Current Number of Lots	489
Buildout Flow - Current Flow	205704
Number of ERUs at 350 gpd/each	588
Total ERUs	1077
Total Current ERUs	362
Total New ERUs	715
Cost per each new ERU	$ 432

Appendices

Water System Hydraulic Analysis

Peak Demand, One Pump Running, Plant at 50 psi

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****************************************************************
*                        E P A N E T                          *
*              Hydraulic and Water Quality                    *
*              Analysis for Pipe Networks                     *
*                      Version 1.1e                           *
****************************************************************

Peak Demand, Existing Conditions, One Pump, 50 Psi off point

   Input Data File ................... BAHIAV4.INP
   Output Report File ................ BAHIA.OUT
   Verification File .................
   Hydraulics File ...................
   Map File .......................... BAHIA.MAP
   Number of Pipes ................... 77
   Number of Nodes ................... 65
   Number of Tanks ................... 1
   Number of Pumps ................... 1
   Number of Valves .................. 1
   Headloss Formula .................. Hazen-Williams
   Hydraulic Timestep ................ 1.00 hrs
   Hydraulic Accuracy ................ 0.001000
   Maximum Trials .................... 40
   Quality Analysis .................. None
   Specific Gravity .................. 1.00
   Kinematic Viscosity ............... 1.10e-05 sq ft/sec
   Chemical Diffusivity .............. 1.30e-08 sq ft/sec
   Total Duration .................... 0.00 hrs
   Reporting Criteria:
      All Nodes
      All Links
```

Node Results:

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
3	87.00	1.67	202.28	49.95
4	87.00	1.67	202.28	49.95
5	87.00	0.00	298.73	91.74
6	87.00	1.67	202.29	49.96
10	87.00	1.67	202.39	50.00
20	86.00	1.67	200.56	49.64
30	89.00	1.67	199.67	47.95
40	84.00	1.67	200.46	50.46
50	82.00	1.67	200.44	51.32
60	92.00	1.67	199.84	46.73
70	84.00	1.67	200.40	50.43
80	87.00	1.67	200.06	48.99
90	82.00	1.67	199.78	51.03
100	83.00	1.67	199.80	50.61
110	85.00	1.67	200.09	49.87

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
120	87.00	1.67	200.39	49.13
130	91.00	1.67	200.33	47.37
140	98.00	1.67	200.33	44.34
150	85.00	1.67	199.82	49.75
160	84.00	1.67	199.78	50.17
170	85.00	1.67	200.30	49.96
180	85.00	1.67	200.82	50.19
190	85.00	1.67	201.51	50.48
200	87.00	1.67	201.99	49.82
210	84.00	1.67	199.18	49.91
220	82.00	1.67	199.36	50.85
230	91.00	0.00	200.26	47.34
250	78.00	1.67	199.67	52.72
260	84.00	1.67	199.67	50.12
270	84.00	1.67	199.68	50.12
280	90.00	1.67	198.69	47.09
290	84.00	1.67	199.27	49.95
310	85.00	1.67	198.72	49.28
320	85.00	1.67	198.81	49.32
330	80.00	1.67	199.18	51.64
340	82.00	1.67	199.63	50.97
350	77.00	1.67	199.62	53.13
360	68.00	1.67	199.62	57.03
370	78.00	1.67	198.71	52.30
400	88.00	4.13	199.89	48.48
410	85.00	4.13	199.26	49.51
420	84.00	4.13	198.86	49.77
430	78.00	4.13	198.62	52.26
440	80.00	4.13	198.48	51.34
450	85.00	4.13	198.41	49.14
460	88.00	4.13	198.39	47.83
470	80.00	4.13	198.66	51.42
480	85.00	4.13	198.30	49.09
500	90.00	0.00	198.32	46.94
510	87.00	0.00	198.31	48.23
520	76.00	4.13	198.44	53.05
530	78.00	4.13	198.29	52.12
540	75.00	4.13	198.27	53.41
550	81.00	4.13	198.20	50.78
560	85.00	4.13	198.15	49.03
570	76.00	4.13	198.31	53.00
580	80.00	4.13	198.20	51.22
590	83.00	4.13	198.15	49.89
600	85.00	4.13	198.13	49.02
610	88.00	4.13	198.12	47.71
620	86.00	4.13	198.12	48.58

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi	
630	89.00	4.13	198.11	47.28	
640	84.00	1.67	183.66	43.18	
660	84.00	25.00	172.58	38.38	
1	30.00	-175.14	30.00	0.00	Reservoir

Link Results:

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
11	10	20	4.00	95.92	2.45	6.13
31	20	230	6.00	65.01	0.74	0.41
41	40	20	4.00	-29.24	0.75	0.68
51	40	50	2.00	1.67	0.17	0.10
61	40	60	2.50	10.55	0.69	1.02
71	40	70	4.00	15.35	0.39	0.21
81	70	80	2.00	4.46	0.46	0.61
101	100	90	2.00	1.67	0.17	0.10
91	80	100	2.00	5.35	0.55	0.86
111	110	80	2.00	2.56	0.26	0.22
121	110	120	2.00	-4.23	0.43	0.56
125	70	120	4.00	7.50	0.19	0.05
131	130	120	2.00	-1.60	0.16	0.09
141	70	140	2.00	1.73	0.18	0.11
145	140	130	2.00	0.07	0.01	0.00
161	100	160	2.00	2.02	0.21	0.14
151	160	150	2.00	-2.76	0.28	0.25
171	170	150	2.00	4.42	0.45	0.60
181	180	170	4.00	67.55	1.72	3.20
191	190	180	4.00	69.22	1.77	3.35
201	200	190	4.00	70.89	1.81	3.50
35	30	60	2.50	-8.88	0.58	0.74
211	170	210	2.00	7.56	0.77	1.63
221	220	210	2.50	5.55	0.36	0.31
222	30	220	2.50	7.21	0.47	0.50
251	160	250	2.00	3.11	0.32	0.32
261	250	260	4.00	-0.51	0.01	0.00
271	260	270	4.00	-2.18	0.06	0.01
275	170	270	4.00	53.90	1.38	2.11
281	210	280	2.50	11.44	0.75	1.18
292	270	290	4.00	37.17	0.95	1.06
295	280	290	4.00	-35.50	0.91	0.97
315	310	320	2.50	-6.51	0.43	0.42
318	280	310	2.50	-3.18	0.21	0.11
325	320	330	2.50	-8.18	0.53	0.64

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft	
335	340	330	2.50	9.84	0.64	0.90	
341	270	340	4.00	12.89	0.33	0.15	
345	340	350	2.50	1.38	0.09	0.02	
361	250	360	2.00	1.96	0.20	0.13	
365	350	360	2.50	-0.29	0.02	0.00	
371	310	370	2.50	1.67	0.11	0.03	
405	230	400	4.00	65.01	1.66	2.98	
408	400	410	4.00	52.73	1.35	2.03	
411	410	420	4.00	41.97	1.07	1.33	
421	420	430	4.00	32.55	0.83	0.83	
431	430	440	4.00	23.85	0.61	0.47	
441	440	450	4.00	15.70	0.40	0.22	
451	450	460	4.00	7.80	0.20	0.06	
501	280	500	4.00	48.45	1.24	1.73	
511	500	510	6.00	21.79	0.25	0.05	
515	510	480	6.00	21.79	0.25	0.05	
471	400	470	2.00	8.15	0.83	1.87	
521	410	520	2.00	6.63	0.68	1.28	
481	470	480	2.00	4.02	0.41	0.51	
525	520	530	2.00	2.49	0.25	0.21	
531	480	530	6.00	21.67	0.25	0.05	
551	540	550	4.00	17.06	0.44	0.25	
541	530	540	6.00	20.03	0.23	0.05	
561	550	560	4.00	13.35	0.34	0.16	
571	420	570	2.00	5.29	0.54	0.84	
545	570	540	2.00	1.16	0.12	0.05	
581	430	580	2.00	4.56	0.47	0.64	
591	440	590	2.00	4.02	0.41	0.51	
555	580	550	2.00	0.43	0.04	0.01	
565	590	560	2.00	-0.11	0.01	0.00	
601	560	600	4.00	9.11	0.23	0.08	
611	600	610	4.00	4.60	0.12	0.02	
621	450	620	2.00	3.76	0.38	0.45	
631	460	630	2.00	3.67	0.37	0.43	
635	630	610	2.00	-0.46	0.05	0.01	
625	600	620	2.00	0.38	0.04	0.01	
7	10	200	4.00	72.55	1.85	3.66	
655	640	660	2.00	25.00	2.55	14.90	
645	500	640	2.00	26.67	2.72	16.78	
6	10	6	2.00	5.00	0.51	0.76	
4	6	4	2.00	1.67	0.17	0.10	
3	3	6	2.00	-1.67	0.17	0.10	
1	1	5		175.14	12 hp	-268.73	Pump
9	5	10	4.00	175.14	4.47	96.33	PRV

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*****************************************************************
*                       E P A N E T                             *
*              Hydraulic and Water Quality                      *
*              Analysis for Pipe Networks                       *
*                    Version 1.1e                               *
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Current Conditions, Irrigation Demand, Both Pumps On, Mid Cycle 60psi

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Input Data File ................... BAHIAV4.INP
Output Report File ................ 2PRIRRDEM60.OUT
Verification File .................
Hydraulics File ...................
Map File .......................... BAHIA.MAP
Number of Pipes ................... 77
Number of Nodes ................... 65
Number of Tanks ................... 1
Number of Pumps ................... 1
Number of Valves .................. 1
Headloss Formula .................. Hazen-Williams
Hydraulic Timestep ................ 1.00 hrs
Hydraulic Accuracy ................ 0.001000
Maximum Trials .................... 40
Quality Analysis .................. None
Specific Gravity .................. 1.00
Kinematic Viscosity ............... 1.10e-05 sq ft/sec
Chemical Diffusivity .............. 1.30e-08 sq ft/sec
Total Duration .................... 0.00 hrs
Reporting Criteria:
   All Nodes
   All Links
```

Node Results:

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
3	87.00	5.44	224.48	59.57
4	87.00	5.44	224.46	59.56
5	87.00	0.00	252.68	71.79
6	87.00	5.44	224.56	59.60
10	87.00	5.44	225.47	60.00
20	86.00	5.44	211.84	54.53
30	89.00	5.44	205.54	50.50
40	84.00	5.44	211.09	55.07
50	82.00	5.44	210.94	55.87
60	92.00	5.44	206.69	49.70
70	84.00	5.44	210.59	54.85
80	87.00	5.44	208.07	52.46
90	82.00	5.44	206.18	53.81
100	83.00	5.44	206.38	53.46
110	85.00	5.44	208.30	53.42

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
120	87.00	5.44	210.52	53.52
130	91.00	5.44	210.02	51.57
140	98.00	5.44	210.02	48.54
150	85.00	5.44	206.56	52.67
160	84.00	5.44	206.29	52.99
170	85.00	5.44	210.35	54.32
180	85.00	5.44	214.11	55.94
190	85.00	5.44	219.03	58.08
200	87.00	5.44	222.50	58.71
210	84.00	5.44	202.59	51.39
220	82.00	5.44	203.59	52.68
230	91.00	0.00	209.72	51.44
250	78.00	5.44	205.87	55.41
260	84.00	5.44	205.88	52.81
270	84.00	5.44	205.94	52.83
280	90.00	5.44	199.61	47.49
290	84.00	5.44	203.32	51.70
310	85.00	5.44	199.71	49.71
320	85.00	5.44	200.24	49.93
330	80.00	5.44	202.53	53.09
340	82.00	5.44	205.60	53.56
350	77.00	5.44	205.46	55.66
360	68.00	5.44	205.46	59.56
370	78.00	5.44	199.58	52.68
400	88.00	13.48	207.02	51.57
410	85.00	13.48	202.56	50.94
420	84.00	13.48	199.71	50.14
430	78.00	13.48	197.91	51.96
440	80.00	13.48	196.87	50.64
450	85.00	13.48	196.40	48.27
460	88.00	13.48	196.27	46.91
470	80.00	13.48	198.85	51.50
480	85.00	13.48	197.17	48.60
500	90.00	0.00	197.43	46.55
510	87.00	0.00	197.28	47.79
520	76.00	13.48	197.37	52.59
530	78.00	13.48	196.94	51.54
540	75.00	13.48	196.76	52.76
550	81.00	13.48	195.81	49.75
560	85.00	13.48	195.24	47.77
570	76.00	13.48	196.75	52.32
580	80.00	13.48	195.70	50.13
590	83.00	13.48	195.01	48.53
600	85.00	13.48	194.96	47.65
610	88.00	13.48	194.88	46.31
620	86.00	13.48	194.68	47.09

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi	
630	89.00	13.48	194.62	45.76	
640	84.00	5.44	175.62	39.70	
660	84.00	27.62	162.29	33.92	
1	30.00	-517.21	30.00	0.00	Reservoir

Link Results:

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
11	10	20	4.00	283.28	7.23	45.44
31	20	230	6.00	189.07	2.15	2.99
41	40	20	4.00	-88.77	2.27	5.31
51	40	50	2.00	5.44	0.56	0.89
61	40	60	2.50	30.41	1.99	7.22
71	40	70	4.00	47.50	1.21	1.67
81	70	80	2.00	13.18	1.35	4.56
101	100	90	2.00	5.44	0.56	0.89
91	80	100	2.00	14.89	1.52	5.71
111	110	80	2.00	7.14	0.73	1.47
121	110	120	2.00	-12.57	1.28	4.18
125	70	120	4.00	23.25	0.59	0.45
131	130	120	2.00	-5.24	0.53	0.83
141	70	140	2.00	5.63	0.58	0.95
145	140	130	2.00	0.20	0.02	0.00
161	100	160	2.00	4.02	0.41	0.51
151	160	150	2.00	-8.03	0.82	1.82
171	170	150	2.00	13.46	1.37	4.74
181	180	170	4.00	195.89	5.00	22.96
191	190	180	4.00	201.32	5.14	24.16
201	200	190	4.00	206.76	5.28	25.38
35	30	60	2.50	-24.97	1.63	5.01
211	170	210	2.00	21.55	2.20	11.32
221	220	210	2.50	14.10	0.92	1.74
222	30	220	2.50	19.53	1.28	3.18
251	160	250	2.00	6.61	0.67	1.27
261	250	260	4.00	-4.67	0.12	0.02
271	260	270	4.00	-10.11	0.26	0.10
275	170	270	4.00	155.44	3.97	14.97
281	210	280	2.50	30.22	1.97	7.13
292	270	290	4.00	101.85	2.60	6.85
295	280	290	4.00	-96.42	2.46	6.19
315	310	320	2.50	-16.72	1.09	2.39
318	280	310	2.50	-5.85	0.38	0.34
325	320	330	2.50	-22.15	1.45	4.02

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft	
335	340	330	2.50	27.59	1.80	6.03	
341	270	340	4.00	38.04	0.97	1.11	
345	340	350	2.50	5.02	0.33	0.26	
361	250	360	2.00	5.85	0.60	1.01	
365	350	360	2.50	-0.41	0.03	0.00	
371	310	370	2.50	5.44	0.36	0.30	
405	230	400	4.00	189.07	4.83	21.51	
408	400	410	4.00	152.86	3.90	14.51	
411	410	420	4.00	121.50	3.10	9.49	
421	420	430	4.00	94.96	2.42	6.02	
431	430	440	4.00	70.17	1.79	3.44	
441	440	450	4.00	46.38	1.18	1.60	
451	450	460	4.00	23.05	0.59	0.44	
501	280	500	4.00	127.04	3.24	10.31	
511	500	510	6.00	93.99	1.07	0.82	
515	510	480	6.00	93.99	1.07	0.82	
471	400	470	2.00	22.73	2.32	12.49	
521	410	520	2.00	17.88	1.83	8.02	
481	470	480	2.00	9.25	0.94	2.37	
525	520	530	2.00	4.41	0.45	0.60	
531	480	530	6.00	89.76	1.02	0.75	
551	540	550	4.00	66.79	1.71	3.14	
541	530	540	6.00	80.69	0.92	0.62	
561	550	560	4.00	51.14	1.31	1.91	
571	420	570	2.00	13.06	1.33	4.48	
545	570	540	2.00	-0.42	0.04	0.01	
581	430	580	2.00	11.30	1.15	3.43	
591	440	590	2.00	10.31	1.05	2.89	
555	580	550	2.00	-2.18	0.22	0.16	
565	590	560	2.00	-3.17	0.32	0.33	
601	560	600	4.00	34.49	0.88	0.92	
611	600	610	4.00	17.39	0.44	0.26	
621	450	620	2.00	9.85	1.01	2.66	
631	460	630	2.00	9.57	0.98	2.52	
635	630	610	2.00	-3.91	0.40	0.48	
625	600	620	2.00	3.63	0.37	0.42	
7	10	200	4.00	212.19	5.42	26.62	
655	640	660	2.00	27.62	2.82	17.91	
645	500	640	2.00	33.05	3.38	24.97	
6	10	6	2.00	16.31	1.67	6.76	
4	6	4	2.00	5.44	0.56	0.89	
3	3	6	2.00	-5.44	0.56	0.88	
1	1	5		517.21	29 hp	-222.68	Pump
9	5	10	4.00	517.21	13.21	27.21	PRV

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****************************************************************
*                         E P A N E T                          *
*                Hydraulic and Water Quality                   *
*                Analysis for Pipe Networks                    *
*                        Version 1.1e                          *
****************************************************************
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Existing Subdivision, Buildout, Irrigation Demand, Both Pumps, PRV 70

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Input Data File ................... BAHIAV4.INP
Output Report File ................ ESB02P70.OUT
Verification File .................
Hydraulics File ...................
Map File .......................... BAHIA.MAP
Number of Pipes ................... 77
Number of Nodes ................... 65
Number of Tanks ................... 1
Number of Pumps ................... 1
Number of Valves .................. 1
Headloss Formula .................. Hazen-Williams
Hydraulic Timestep ................ 1.00 hrs
Hydraulic Accuracy ................ 0.001000
Maximum Trials .................... 40
Quality Analysis .................. None
Specific Gravity .................. 1.00
Kinematic Viscosity ............... 1.10e-05 sq ft/sec
Chemical Diffusivity .............. 1.30e-08 sq ft/sec
Total Duration .................... 0.00 hrs
Reporting Criteria:
   All Nodes
   All Links
```

Node Results:

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
3	87.00	7.77	188.40	43.94
4	87.00	7.77	188.37	43.92
5	87.00	0.00	190.33	44.77
6	87.00	7.77	188.56	44.01
10	87.00	7.77	190.33	44.77
20	86.00	7.77	164.76	34.12
30	89.00	7.77	153.04	27.75
40	84.00	7.77	163.34	34.38
50	82.00	7.77	163.05	35.12
60	92.00	7.77	155.17	27.37
70	84.00	7.77	162.39	33.97
80	87.00	7.77	157.66	30.62
90	82.00	7.77	154.18	31.28
100	83.00	7.77	154.57	31.01
110	85.00	7.77	158.08	31.67

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
120	87.00	7.77	162.25	32.61
130	91.00	7.77	161.28	30.45
140	98.00	7.77	161.28	27.42
150	85.00	7.77	154.94	30.30
160	84.00	7.77	154.43	30.52
170	85.00	7.77	162.11	33.41
180	85.00	7.77	169.11	36.45
190	85.00	7.77	178.29	40.42
200	87.00	7.77	184.78	42.37
210	84.00	7.77	147.73	27.62
220	82.00	7.77	149.49	29.24
230	91.00	0.00	160.80	30.24
250	78.00	7.77	153.75	32.82
260	84.00	7.77	153.78	30.23
270	84.00	7.77	153.89	30.28
280	90.00	7.77	142.36	22.69
290	84.00	7.77	149.11	28.21
310	85.00	7.77	142.52	24.92
320	85.00	7.77	143.45	25.33
330	80.00	7.77	147.61	29.29
340	82.00	7.77	153.26	30.88
350	77.00	7.77	152.98	32.92
360	68.00	7.77	152.99	36.82
370	78.00	7.77	142.25	27.84
400	88.00	19.26	155.76	29.36
410	85.00	19.26	147.43	27.05
420	84.00	19.26	142.12	25.18
430	78.00	19.26	138.74	26.32
440	80.00	19.26	136.80	24.61
450	85.00	19.26	135.90	22.05
460	88.00	19.26	135.65	20.65
470	80.00	19.26	140.75	26.32
480	85.00	19.26	137.91	22.93
500	90.00	0.00	138.45	20.99
510	87.00	0.00	138.14	22.16
520	76.00	19.26	138.05	26.89
530	78.00	19.26	137.44	25.75
540	75.00	19.26	137.06	26.89
550	81.00	19.26	135.15	23.46
560	85.00	19.26	134.00	21.23
570	76.00	19.26	136.99	26.43
580	80.00	19.26	134.82	23.75
590	83.00	19.26	133.44	21.86
600	85.00	19.26	133.44	20.99
610	88.00	19.26	133.27	19.61
620	86.00	19.26	132.78	20.27

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi	
630	89.00	19.26	132.68	18.93	
640	84.00	7.77	114.49	13.21	
660	84.00	27.00	101.72	7.68	
1	30.00	-726.63	30.00	0.00	Reservoir

Link Results:

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
11	10	20	4.00	398.00	10.16	85.24
31	20	230	6.00	264.95	3.01	5.57
41	40	20	4.00	-125.29	3.20	10.05
51	40	50	2.00	7.77	0.79	1.71
61	40	60	2.50	42.51	2.78	13.41
71	40	70	4.00	67.25	1.72	3.18
81	70	80	2.00	18.51	1.89	8.54
101	100	90	2.00	7.77	0.79	1.71
91	80	100	2.00	20.65	2.11	10.45
111	110	80	2.00	9.90	1.01	2.69
121	110	120	2.00	-17.67	1.80	7.84
125	70	120	4.00	32.92	0.84	0.85
131	130	120	2.00	-7.49	0.76	1.60
141	70	140	2.00	8.05	0.82	1.83
145	140	130	2.00	0.28	0.03	0.00
161	100	160	2.00	5.11	0.52	0.79
151	160	150	2.00	-11.23	1.15	3.39
171	170	150	2.00	19.00	1.94	8.96
181	180	170	4.00	274.26	7.00	42.80
191	190	180	4.00	282.03	7.20	45.07
201	200	190	4.00	289.80	7.40	47.39
35	30	60	2.50	-34.74	2.27	9.24
211	170	210	2.00	30.08	3.07	20.97
221	220	210	2.50	19.21	1.26	3.09
222	30	220	2.50	26.97	1.76	5.78
251	160	250	2.00	8.58	0.88	2.06
261	250	260	4.00	-7.40	0.19	0.05
271	260	270	4.00	-15.17	0.39	0.20
275	170	270	4.00	217.42	5.55	27.85
281	210	280	2.50	41.52	2.71	12.84
292	270	290	4.00	141.04	3.60	12.51
295	280	290	4.00	-133.28	3.40	11.26
315	310	320	2.50	-22.82	1.49	4.24
318	280	310	2.50	-7.29	0.48	0.51
325	320	330	2.50	-30.59	2.00	7.30

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft	
335	340	330	2.50	38.35	2.51	11.09	
341	270	340	4.00	53.44	1.36	2.08	
345	340	350	2.50	7.32	0.48	0.52	
361	250	360	2.00	8.21	0.84	1.90	
365	350	360	2.50	-0.45	0.03	0.00	
371	310	370	2.50	7.77	0.51	0.58	
405	230	400	4.00	264.95	6.76	40.15	
408	400	410	4.00	214.12	5.47	27.07	
411	410	420	4.00	170.23	4.35	17.71	
421	420	430	4.00	133.38	3.41	11.28	
431	430	440	4.00	98.70	2.52	6.46	
441	440	450	4.00	65.27	1.67	3.01	
451	450	460	4.00	32.43	0.83	0.82	
501	280	500	4.00	174.31	4.45	18.51	
511	500	510	6.00	139.55	1.58	1.70	
515	510	480	6.00	139.55	1.58	1.70	
471	400	470	2.00	31.57	3.22	22.93	
521	410	520	2.00	24.63	2.52	14.49	
481	470	480	2.00	12.31	1.26	4.01	
525	520	530	2.00	5.37	0.55	0.86	
531	480	530	6.00	132.59	1.50	1.55	
551	540	550	4.00	97.76	2.50	6.35	
541	530	540	6.00	118.70	1.35	1.26	
561	550	560	4.00	74.65	1.91	3.85	
571	420	570	2.00	17.59	1.80	7.77	
545	570	540	2.00	-1.68	0.17	0.10	
581	430	580	2.00	15.41	1.57	6.09	
591	440	590	2.00	14.17	1.45	5.21	
555	580	550	2.00	-3.85	0.39	0.47	
565	590	560	2.00	-5.09	0.52	0.78	
601	560	600	4.00	50.30	1.28	1.86	
611	600	610	4.00	25.35	0.65	0.52	
621	450	620	2.00	13.58	1.39	4.82	
631	460	630	2.00	13.17	1.35	4.55	
635	630	610	2.00	-6.09	0.62	1.09	
625	600	620	2.00	5.68	0.58	0.96	
7	10	200	4.00	297.56	7.60	49.77	
655	640	660	2.00	27.00	2.76	17.17	
645	500	640	2.00	34.77	3.55	27.42	
6	10	6	2.00	23.30	2.38	13.08	
4	6	4	2.00	7.77	0.79	1.71	
3	3	6	2.00	-7.77	0.79	1.71	
1	1	5		726.63	29 hp	-160.33	Pump
9	5	10	4.00	726.63	18.55	0.00	PRV

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******************************************************************
*                         E P A N E T                            *
*                 Hydraulic and Water Quality                    *
*                 Analysis for Pipe Networks                     *
*                         Version 1.1e                           *
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Cluster irrigation conditions, one pump, low end of pressure range

```
  Input Data File ................... CLUSTER.INP
  Output Report File ................ CLUSTER.OUT
  Verification File .................
  Hydraulics File ...................
  Map File .......................... CLUSTER.MAP
  Number of Pipes ................... 77
  Number of Nodes ................... 65
  Number of Tanks ................... 1
  Number of Pumps ................... 1
  Number of Valves .................. 1
  Headloss Formula .................. Hazen-Williams
  Hydraulic Timestep ................ 1.00 hrs
  Hydraulic Accuracy ................ 0.001000
  Maximum Trials .................... 40
  Quality Analysis .................. None
  Specific Gravity .................. 1.00
  Kinematic Viscosity ............... 1.10e-05 sq ft/sec
  Chemical Diffusivity .............. 1.30e-08 sq ft/sec
  Total Duration .................... 0.00 hrs
  Reporting Criteria:
     All Nodes
     All Links
```

Node Results:

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
3	87.00	1.68	179.20	39.95
4	87.00	1.68	179.20	39.95
5	87.00	0.00	217.86	56.70
6	87.00	1.68	179.21	39.95
10	87.00	1.68	179.31	40.00
20	86.00	1.68	173.14	37.76
30	89.00	1.68	171.12	35.58
40	84.00	1.68	172.99	38.56
50	82.00	1.68	172.97	39.42
60	92.00	1.68	171.56	34.48
70	84.00	1.68	172.91	38.53
80	87.00	1.68	172.43	37.02
90	82.00	1.68	171.98	38.99
100	83.00	1.68	172.01	38.57
110	85.00	1.68	172.49	37.91

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
120	87.00	1.68	172.90	37.22
130	91.00	1.68	172.85	35.46
140	98.00	1.68	172.85	32.43
150	85.00	1.68	172.07	37.73
160	84.00	1.68	171.93	38.10
170	85.00	1.68	173.27	38.25
180	85.00	1.68	174.82	38.92
190	85.00	1.68	176.81	39.78
200	87.00	1.68	178.17	39.51
210	84.00	1.68	169.50	37.05
220	82.00	1.68	170.18	38.21
230	91.00	0.00	171.83	35.02
250	78.00	1.68	171.39	40.47
260	84.00	1.68	171.38	37.86
270	84.00	1.68	171.38	37.86
280	90.00	1.68	167.49	33.58
290	84.00	1.68	169.83	37.19
310	85.00	1.68	167.89	35.92
320	85.00	1.68	168.34	36.11
330	80.00	1.68	169.76	38.89
340	82.00	1.68	171.27	38.68
350	77.00	1.68	171.27	40.85
360	68.00	1.68	171.28	44.75
370	78.00	1.68	167.88	38.94
400	88.00	4.17	170.15	35.60
410	85.00	4.17	168.07	35.99
420	84.00	4.17	167.35	36.12
430	78.00	4.17	166.90	38.52
440	80.00	4.17	166.65	37.55
450	85.00	4.17	166.53	35.33
460	88.00	4.17	166.50	34.01
470	80.00	75.00	146.43	28.79
480	85.00	4.17	165.62	34.93
500	90.00	0.00	165.82	32.85
510	87.00	0.00	165.71	34.10
520	76.00	75.00	145.45	30.09
530	78.00	4.17	165.56	37.94
540	75.00	4.17	165.55	39.24
550	81.00	4.17	165.55	36.63
560	85.00	4.17	165.54	34.90
570	76.00	4.17	165.98	38.99
580	80.00	4.17	165.83	37.19
590	83.00	4.17	165.73	35.85
600	85.00	4.17	165.54	34.90
610	88.00	4.17	165.54	33.60
620	86.00	4.17	165.69	34.53

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi	
630	89.00	4.17	165.65	33.21	
640	84.00	1.68	151.15	29.09	
660	84.00	25.00	140.07	24.29	
1	30.00	-318.00	30.00	0.00	Reservoir

Link Results:

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
11	10	20	4.00	184.66	4.71	20.59
31	20	230	6.00	145.94	1.66	1.85
41	40	20	4.00	-37.05	0.95	1.05
51	40	50	2.00	1.68	0.17	0.10
61	40	60	2.50	16.53	1.08	2.34
71	40	70	4.00	17.15	0.44	0.25
81	70	80	2.00	5.38	0.55	0.87
101	100	90	2.00	1.68	0.17	0.10
91	80	100	2.00	7.07	0.72	1.44
111	110	80	2.00	3.38	0.34	0.37
121	110	120	2.00	-5.06	0.52	0.77
125	70	120	4.00	8.34	0.21	0.07
131	130	120	2.00	-1.60	0.16	0.09
141	70	140	2.00	1.76	0.18	0.11
145	140	130	2.00	0.08	0.01	0.00
161	100	160	2.00	3.71	0.38	0.44
151	160	150	2.00	-5.54	0.57	0.92
171	170	150	2.00	7.22	0.74	1.50
181	180	170	4.00	121.57	3.10	9.50
191	190	180	4.00	123.25	3.15	9.75
201	200	190	4.00	124.93	3.19	9.99
35	30	60	2.50	-14.85	0.97	1.92
211	170	210	2.00	14.58	1.49	5.49
221	220	210	2.50	11.50	0.75	1.19
222	30	220	2.50	13.18	0.86	1.54
251	160	250	2.00	7.58	0.77	1.64
261	250	260	4.00	3.04	0.08	0.01
271	260	270	4.00	1.36	0.03	0.00
275	170	270	4.00	98.09	2.50	6.39
281	210	280	2.50	24.40	1.59	4.80
292	270	290	4.00	76.81	1.96	4.06
295	280	290	4.00	-75.13	1.92	3.90
315	310	320	2.50	-15.42	1.01	2.05
318	280	310	2.50	-12.06	0.79	1.30
325	320	330	2.50	-17.10	1.12	2.49

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft	
335	340	330	2.50	18.78	1.23	2.96	
341	270	340	4.00	20.96	0.54	0.37	
345	340	350	2.50	0.50	0.03	0.00	
361	250	360	2.00	2.86	0.29	0.27	
365	350	360	2.50	-1.18	0.08	0.02	
371	310	370	2.50	1.68	0.11	0.03	
405	230	400	4.00	145.94	3.73	13.32	
408	400	410	4.00	101.34	2.59	6.78	
411	410	420	4.00	57.55	1.47	2.38	
421	420	430	4.00	44.76	1.14	1.50	
431	430	440	4.00	32.92	0.84	0.85	
441	440	450	4.00	21.73	0.55	0.39	
451	450	460	4.00	10.86	0.28	0.11	
501	280	500	4.00	109.90	2.81	7.88	
511	500	510	6.00	83.22	0.94	0.65	
515	510	480	6.00	83.22	0.94	0.65	
471	400	470	2.00	40.43	4.13	36.25	
521	410	520	2.00	39.63	4.05	34.93	
481	470	480	2.00	-34.57	3.53	27.13	
525	520	530	2.00	-35.37	3.61	28.30	
531	480	530	6.00	44.49	0.50	0.21	
551	540	550	4.00	5.23	0.13	0.03	
541	530	540	6.00	4.95	0.06	0.00	
561	550	560	4.00	4.57	0.12	0.02	
571	420	570	2.00	8.62	0.88	2.08	
545	570	540	2.00	4.45	0.45	0.61	
581	430	580	2.00	7.67	0.78	1.67	
591	440	590	2.00	7.03	0.72	1.42	
555	580	550	2.00	3.50	0.36	0.39	
565	590	560	2.00	2.86	0.29	0.27	
601	560	600	4.00	3.27	0.08	0.01	
611	600	610	4.00	1.64	0.04	0.00	
621	450	620	2.00	6.71	0.69	1.31	
631	460	630	2.00	6.69	0.68	1.30	
635	630	610	2.00	2.52	0.26	0.21	
625	600	620	2.00	-2.54	0.26	0.22	
7	10	200	4.00	126.61	3.23	10.24	
655	640	660	2.00	25.00	2.55	14.89	
645	500	640	2.00	26.68	2.72	16.80	
6	10	6	2.00	5.04	0.51	0.77	
4	6	4	2.00	1.68	0.17	0.10	
3	3	6	2.00	-1.68	0.17	0.10	
1	1	5		318.00	15 hp	-187.86	Pump
9	5	10	4.00	318.00	8.12	38.55	PRV

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****************************************************************
*                        E P A N E T                           *
*              Hydraulic and Water Quality                     *
*              Analysis for Pipe Networks                      *
*                      Version 1.1e                            *
****************************************************************
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Peak Irrigation Demand, Opt2 Build Out

```
  Input Data File ................... BOPT2.INP
  Output Report File ................ BOPT2.OUT
  Verification File .................
  Hydraulics File ...................
  Map File .......................... BOPT2.MAP
  Number of Pipes ................... 121
  Number of Nodes ................... 99
  Number of Tanks ................... 2
  Number of Pumps ................... 2
  Number of Valves .................. 2
  Headloss Formula .................. Hazen-Williams
  Hydraulic Timestep ................ 1.00 hrs
  Hydraulic Accuracy ................ 0.001000
  Maximum Trials .................... 40
  Quality Analysis .................. None
  Specific Gravity .................. 1.00
  Kinematic Viscosity ............... 1.10e-05 sq ft/sec
  Chemical Diffusivity .............. 1.30e-08 sq ft/sec
  Total Duration .................... 0.00 hrs
  Reporting Criteria:
     All Nodes
     All Links
```

Node Results:

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
3	87.00	7.32	217.23	56.43
4	87.00	7.32	217.21	56.42
5	87.00	0.00	218.96	57.18
6	87.00	7.32	217.38	56.49
10	87.00	7.32	218.96	57.18
20	86.00	7.32	212.95	55.01
30	89.00	7.32	212.36	53.45
40	84.00	7.32	212.53	55.69
50	82.00	7.32	212.27	56.44
60	92.00	7.32	212.35	52.15
70	84.00	7.32	212.07	55.49
80	87.00	7.32	211.08	53.77
90	82.00	7.32	210.72	55.78
100	83.00	7.32	211.07	55.49
110	85.00	7.32	211.09	54.63

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
120	87.00	7.32	212.01	54.17
130	91.00	7.32	211.11	52.04
140	98.00	7.32	211.11	49.01
150	85.00	7.32	212.05	55.05
160	84.00	7.32	211.92	55.43
170	85.00	7.32	215.41	56.51
180	85.00	7.32	216.18	56.84
190	85.00	7.32	217.29	57.32
200	87.00	7.32	218.16	56.83
210	84.00	7.32	214.17	56.40
220	82.00	7.32	212.84	56.69
230	91.00	0.00	212.18	52.51
250	78.00	7.32	213.97	58.91
260	84.00	7.32	214.27	56.45
270	84.00	7.32	214.77	56.66
280	90.00	7.32	215.07	54.19
290	84.00	7.32	214.84	56.69
310	85.00	7.32	214.11	55.94
320	85.00	7.32	214.06	55.92
330	80.00	7.32	214.11	58.11
340	82.00	7.32	214.57	57.44
350	77.00	7.32	213.94	59.34
360	68.00	7.32	213.82	63.19
370	78.00	7.32	213.87	58.87
400	88.00	18.15	211.19	53.38
410	85.00	18.15	209.55	53.97
420	84.00	18.15	208.49	53.94
430	78.00	18.15	207.84	56.26
440	80.00	18.15	207.49	55.24
450	85.00	18.15	207.35	53.02
460	88.00	18.15	207.33	51.70
470	80.00	18.15	211.07	56.79
480	85.00	18.15	215.58	56.58
500	90.00	0.00	215.69	54.46
510	87.00	0.00	215.63	55.73
520	76.00	18.15	209.55	57.87
530	78.00	18.15	215.47	59.57
540	75.00	18.15	215.43	60.85
550	81.00	18.15	215.37	58.22
560	85.00	18.15	215.44	56.52
570	76.00	18.15	208.57	57.44
580	80.00	18.15	207.97	55.45
590	83.00	18.15	207.68	54.02
600	85.00	18.15	215.96	56.74
610	88.00	18.15	217.57	56.14
620	86.00	18.15	207.69	52.73

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi	
630	89.00	18.15	208.61	51.83	
660	84.00	109.80	221.42	59.54	
1005	85.00	0.00	230.24	62.93	
1010	85.00	0.00	230.24	62.93	
1020	84.00	18.15	228.02	62.40	
1030	83.00	18.15	221.96	60.21	
1040	82.00	18.15	218.75	59.25	
1050	86.00	18.15	216.53	56.56	
1070	90.00	18.15	216.01	54.60	
1080	89.00	18.15	215.58	54.85	
1090	84.00	18.15	215.92	57.16	
1100	83.00	18.15	216.61	57.89	
1110	84.00	18.15	216.13	57.25	
1120	87.00	18.15	215.54	55.70	
1150	85.00	18.15	215.72	56.64	
1160	85.00	18.15	215.41	56.51	
1170	86.00	18.15	215.72	56.21	
1180	85.00	18.15	215.46	56.53	
1190	84.00	18.15	216.18	57.27	
1200	89.00	18.15	215.97	55.02	
1210	80.00	18.15	217.68	59.66	
1220	83.00	18.15	217.56	58.31	
1230	79.00	18.15	218.88	60.61	
1240	75.00	18.15	219.05	62.42	
1250	75.00	18.15	220.85	63.20	
1260	80.00	18.15	218.39	59.96	
1270	90.00	18.15	218.09	55.50	
1280	80.00	18.15	219.68	60.52	
1300	99.00	18.15	218.52	51.79	
1310	69.00	18.15	224.16	67.23	
1320	17.00	18.15	226.20	90.65	
1330	72.00	18.15	223.28	65.55	
1340	78.00	18.15	221.09	62.00	
1350	83.00	18.15	221.25	59.90	
1400	71.00	18.15	225.50	66.95	
1410	68.00	18.15	222.85	67.10	
1	30.00	-316.15	30.00	0.00	Reservoir
1000	35.00	-1026.63	35.00	0.00	Reservoir

Link Results:

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
11	10	20	4.00	182.02	4.65	20.05
31	20	230	6.00	109.59	1.24	1.09
41	40	20	4.00	-65.11	1.66	2.99
51	40	50	2.00	7.32	0.75	1.54
61	40	60	2.50	5.44	0.36	0.30
71	40	70	4.00	45.03	1.15	1.51
81	70	80	2.00	7.95	0.81	1.79
101	100	90	2.00	7.32	0.75	1.54
91	80	100	2.00	1.11	0.11	0.05
111	110	80	2.00	0.49	0.05	0.01
121	110	120	2.00	-7.81	0.80	1.73
125	70	120	4.00	22.30	0.57	0.41
131	130	120	2.00	-7.18	0.73	1.48
141	70	140	2.00	7.46	0.76	1.59
145	140	130	2.00	0.14	0.01	0.00
161	100	160	2.00	-13.53	1.38	4.78
151	160	150	2.00	-5.30	0.54	0.85
171	170	150	2.00	12.62	1.29	4.21
181	180	170	4.00	82.90	2.12	4.68
191	190	180	4.00	90.22	2.30	5.47
201	200	190	4.00	97.54	2.49	6.32
35	30	60	2.50	1.88	0.12	0.04
211	170	210	2.00	8.00	0.82	1.81
221	220	210	2.50	-16.52	1.08	2.33
222	30	220	2.50	-9.20	0.60	0.79
251	160	250	2.00	-15.55	1.59	6.18
261	250	260	4.00	-26.18	0.67	0.55
271	260	270	4.00	-33.50	0.86	0.88
275	170	270	4.00	54.95	1.40	2.19
281	210	280	2.50	-15.84	1.03	2.16
292	270	290	4.00	-14.45	0.37	0.18
295	280	290	4.00	21.77	0.56	0.39
315	310	320	2.50	4.70	0.31	0.23
318	280	310	2.50	19.34	1.26	3.13
325	320	330	2.50	-2.62	0.17	0.08
335	340	330	2.50	9.94	0.65	0.91
341	270	340	4.00	28.58	0.73	0.65
345	340	350	2.50	11.32	0.74	1.16
361	250	360	2.00	3.32	0.34	0.36
365	350	360	2.50	4.00	0.26	0.17
371	310	370	2.50	7.32	0.48	0.52
405	230	400	4.00	109.59	2.80	7.84
408	400	410	4.00	89.09	2.27	5.35
411	410	420	4.00	71.05	1.81	3.52
421	420	430	4.00	54.74	1.40	2.17
431	430	440	4.00	39.01	1.00	1.16

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
441	440	450	4.00	23.83	0.61	0.47
451	450	460	4.00	9.78	0.25	0.09
501	280	500	4.00	-64.27	1.64	2.92
511	500	510	6.00	59.79	0.68	0.35
515	510	480	6.00	59.79	0.68	0.35
471	400	470	2.00	2.35	0.24	0.19
521	410	520	2.00	-0.12	0.01	0.00
481	470	480	2.00	-15.81	1.61	6.38
525	520	530	2.00	-18.28	1.87	8.34
531	480	530	6.00	58.54	0.66	0.34
551	540	550	4.00	14.56	0.37	0.19
541	530	540	6.00	37.35	0.42	0.15
561	550	560	4.00	-15.53	0.40	0.21
571	420	570	2.00	-1.84	0.19	0.12
545	570	540	2.00	-19.99	2.04	9.85
581	430	580	2.00	-2.42	0.25	0.20
591	440	590	2.00	-2.98	0.30	0.29
555	580	550	2.00	-20.58	2.10	10.39
565	590	560	2.00	-21.13	2.16	10.91
601	560	600	4.00	-48.43	1.24	1.73
611	600	610	4.00	-84.82	2.17	4.88
621	450	620	2.00	-4.10	0.42	0.53
631	460	630	2.00	-8.38	0.86	1.97
635	630	610	2.00	-26.53	2.71	16.63
625	600	620	2.00	22.25	2.27	12.01
7	10	200	4.00	104.86	2.68	7.23
6	10	6	2.00	21.96	2.24	11.72
4	6	4	2.00	7.32	0.75	1.54
3	3	6	2.00	-7.32	0.75	1.54
1020	1010	1020	8.00	556.63	3.55	5.42
1030	1020	1030	6.00	538.48	6.11	20.70
1040	1030	1040	6.00	374.76	4.25	10.59
1052	500	1050	6.00	-124.06	1.41	1.37
1032	1030	660	4.00	109.80	2.80	7.87
1070	1050	1070	4.00	50.87	1.30	1.90
1072	1070	480	4.00	32.71	0.84	0.84
1082	1080	530	4.00	15.24	0.39	0.20
1090	1080	1090	4.00	-33.39	0.85	0.87
1102	1090	1100	4.00	-51.54	1.32	1.94
1050	1040	1050	6.00	193.08	2.19	3.10
1120	1110	1120	4.00	33.51	0.86	0.88
1122	1120	540	4.00	15.36	0.39	0.21
1045	1040	1100	4.00	163.53	4.18	16.44
1105	1100	1110	4.00	93.83	2.40	5.88
1150	1110	1150	4.00	42.17	1.08	1.34
1160	1150	1160	4.00	26.79	0.68	0.58

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft	
1162	1160	550	4.00	8.64	0.22	0.07	
1170	1150	1170	4.00	-2.77	0.07	0.01	
1180	1170	1180	4.00	24.54	0.63	0.49	
1182	1180	560	4.00	6.38	0.16	0.04	
1190	1170	1190	4.00	-45.46	1.16	1.54	
1200	1190	1200	4.00	22.17	0.57	0.41	
1202	1200	600	4.00	4.02	0.10	0.02	
1210	1190	1210	4.00	-85.79	2.19	4.99	
1220	1210	1220	4.00	15.70	0.40	0.22	
1225	1220	610	4.00	-2.45	0.06	0.01	
1230	1210	1230	4.00	-119.65	3.05	9.22	
1240	1230	1240	4.00	-32.39	0.83	0.82	
1250	1240	1250	4.00	-92.41	2.36	5.72	
1260	1240	1260	4.00	41.87	1.07	1.32	
1270	1260	1270	4.00	23.72	0.61	0.46	
1280	1250	1280	6.00	162.70	1.85	2.26	
1282	1280	1300	6.00	144.55	1.64	1.82	
1302	1300	1270	6.00	126.39	1.43	1.42	
1278	1270	610	6.00	131.96	1.50	1.53	
1310	1250	1310	6.00	-273.27	3.10	5.90	
1320	1310	1400	6.00	-309.57	3.51	7.43	
1330	1320	1330	4.00	124.11	3.17	9.87	
1332	1330	1340	4.00	105.96	2.71	7.37	
1328	1010	1320	8.00	469.99	3.00	3.96	
1350	1340	1350	4.00	-17.61	0.45	0.27	
1355	1030	1350	4.00	35.76	0.91	0.99	
1410	1310	1410	2.00	18.15	1.85	8.24	
1420	1320	1400	6.00	327.73	3.72	8.26	
1349	1340	1230	4.00	105.41	2.69	7.30	
1	1	5		316.15	15 hp	-188.96	Pump
1001	1000	1005		1026.63	51 hp	-195.24	Pump
9	5	10	4.00	316.15	8.07	0.00	PRV
1006	1005	1010	8.00	1026.63	6.55	0.00	PRV

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******************************************************************
*                         E P A N E T                            *
*                Hydraulic and Water Quality                     *
*                Analysis for Pipe Networks                      *
*                       Version 1.1e                             *
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Alternate Two, Development Option B, Includes proposed 6" on 60th Avenue

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Input Data File ................... WMODEL1.INP
Output Report File ................ WMODEL1.OUT
Verification File .................
Hydraulics File ...................
Map File .......................... WMODEL1.MAP
Number of Pipes ................... 122
Number of Nodes ................... 99
Number of Tanks ................... 2
Number of Pumps ................... 2
Number of Valves .................. 2
Headloss Formula .................. Hazen-Williams
Hydraulic Timestep ................ 1.00 hrs
Hydraulic Accuracy ................ 0.001000
Maximum Trials .................... 40
Quality Analysis .................. None
Specific Gravity .................. 1.00
Kinematic Viscosity ............... 1.10e-05 sq ft/sec
Chemical Diffusivity .............. 1.30e-08 sq ft/sec
Total Duration .................... 0.00 hrs
Reporting Criteria:
   All Nodes
   All Links
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Node Results:

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
3	87.00	7.32	221.03	58.07
4	87.00	7.32	221.00	58.06
5	87.00	0.00	222.75	58.82
6	87.00	7.32	221.17	58.14
10	87.00	7.32	222.75	58.82
20	86.00	7.32	217.77	57.10
30	89.00	7.32	216.46	55.23
40	84.00	7.32	217.22	57.72
50	82.00	7.32	216.96	58.48
60	92.00	7.32	216.50	53.95
70	84.00	7.32	216.69	57.49
80	87.00	7.32	215.18	55.54
90	82.00	7.32	214.60	57.45
100	83.00	7.32	214.95	57.17
110	85.00	7.32	215.21	56.42

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
120	87.00	7.32	216.61	56.16
130	91.00	7.32	215.71	54.04
140	98.00	7.32	215.71	51.01
150	85.00	7.32	215.48	56.54
160	84.00	7.32	215.39	56.93
170	85.00	7.32	218.37	57.79
180	85.00	7.32	219.34	58.21
190	85.00	7.32	220.73	58.81
200	87.00	7.32	221.78	58.40
210	84.00	7.32	217.11	57.68
220	82.00	7.32	216.53	58.29
230	91.00	0.00	217.32	54.73
250	78.00	7.32	216.76	60.12
260	84.00	7.32	217.01	57.64
270	84.00	7.32	217.44	57.82
280	90.00	7.32	217.48	55.24
290	84.00	7.32	217.44	57.82
310	85.00	7.32	216.62	57.03
320	85.00	7.32	216.59	57.02
330	80.00	7.32	216.67	59.22
340	82.00	7.32	217.24	58.60
350	77.00	7.32	216.67	60.52
360	68.00	7.32	216.57	64.38
370	78.00	7.32	216.38	59.96
400	88.00	18.15	215.98	55.45
410	85.00	18.15	213.76	55.79
420	84.00	18.15	212.35	55.61
430	78.00	18.15	211.48	57.84
440	80.00	18.15	211.02	56.77
450	85.00	18.15	210.82	54.52
460	88.00	18.15	210.78	53.20
470	80.00	18.15	215.12	58.55
480	85.00	18.15	217.60	57.46
500	90.00	0.00	217.77	55.36
510	87.00	0.00	217.63	56.60
520	76.00	18.15	213.52	59.59
530	78.00	18.15	217.52	60.45
540	75.00	18.15	217.47	61.73
550	81.00	18.15	217.36	59.09
560	85.00	18.15	217.38	57.36
570	76.00	18.15	212.32	59.07
580	80.00	18.15	211.48	56.97
590	83.00	18.15	211.03	55.48
600	85.00	18.15	217.73	57.51
610	88.00	18.15	218.98	56.75
620	86.00	18.15	210.91	54.12

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi	
630	89.00	18.15	211.47	53.07	
660	84.00	109.80	224.50	60.88	
1005	85.00	0.00	229.45	62.59	
1010	85.00	0.00	229.45	62.59	
1020	84.00	18.15	226.82	61.88	
1030	83.00	18.15	225.04	61.55	
1040	82.00	18.15	221.34	60.37	
1050	86.00	18.15	218.76	57.53	
1070	90.00	18.15	218.15	55.53	
1080	89.00	18.15	217.67	55.75	
1090	84.00	18.15	218.07	58.09	
1100	83.00	18.15	218.84	58.86	
1110	84.00	18.15	218.26	58.18	
1120	87.00	18.15	217.60	56.59	
1150	85.00	18.15	217.68	57.49	
1160	85.00	18.15	217.39	57.37	
1170	86.00	18.15	217.66	57.05	
1180	85.00	18.15	217.40	57.37	
1190	84.00	18.15	217.95	58.04	
1200	89.00	18.15	217.74	55.78	
1210	80.00	18.15	219.13	60.29	
1220	83.00	18.15	218.98	58.92	
1230	79.00	18.15	220.20	61.18	
1240	75.00	18.15	220.28	62.95	
1250	75.00	18.15	221.66	63.55	
1260	80.00	18.15	219.66	60.51	
1270	90.00	18.15	219.38	56.06	
1280	80.00	18.15	220.68	60.96	
1300	99.00	18.15	219.73	52.31	
1310	69.00	18.15	224.39	67.33	
1320	17.00	18.15	226.12	90.61	
1330	72.00	18.15	224.01	65.87	
1340	78.00	18.15	222.52	62.62	
1350	83.00	18.15	223.26	60.77	
1400	71.00	18.15	225.53	66.96	
1410	68.00	18.15	223.09	67.20	
1	30.00	-309.80	30.00	0.00	Reservoir
1000	35.00	-1032.98	35.00	0.00	Reservoir

Page 4 Alternate Two, Development Option B, Includes proposed 6" on 60th Avenue

Link Results:

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
11	10	20	4.00	164.49	4.20	16.62
31	20	230	6.00	82.07	0.93	0.64
41	40	20	4.00	-75.10	1.92	3.90
51	40	50	2.00	7.32	0.75	1.54
61	40	60	2.50	11.42	0.75	1.18
71	40	70	4.00	49.04	1.25	1.77
81	70	80	2.00	9.98	1.02	2.72
101	100	90	2.00	7.32	0.75	1.54
91	80	100	2.00	5.12	0.52	0.79
111	110	80	2.00	2.46	0.25	0.20
121	110	120	2.00	-9.78	1.00	2.62
125	70	120	4.00	24.25	0.62	0.48
131	130	120	2.00	-7.15	0.73	1.47
141	70	140	2.00	7.49	0.76	1.60
145	140	130	2.00	0.17	0.02	0.00
161	100	160	2.00	-9.52	0.97	2.50
151	160	150	2.00	-4.32	0.44	0.58
171	170	150	2.00	11.64	1.19	3.62
181	180	170	4.00	94.07	2.40	5.91
191	190	180	4.00	101.39	2.59	6.79
201	200	190	4.00	108.71	2.78	7.73
35	30	60	2.50	-4.10	0.27	0.18
211	170	210	2.00	8.09	0.83	1.85
221	220	210	2.50	-10.54	0.69	1.02
222	30	220	2.50	-3.22	0.21	0.11
251	160	250	2.00	-12.52	1.28	4.14
261	250	260	4.00	-23.69	0.60	0.46
271	260	270	4.00	-31.01	0.79	0.76
275	170	270	4.00	67.02	1.71	3.16
281	210	280	2.50	-9.77	0.64	0.88
292	270	290	4.00	-0.48	0.01	0.00
295	280	290	4.00	7.80	0.20	0.06
315	310	320	2.50	3.58	0.23	0.14
318	280	310	2.50	18.22	1.19	2.80
325	320	330	2.50	-3.74	0.24	0.15
335	340	330	2.50	11.06	0.72	1.11
341	270	340	4.00	29.17	0.74	0.68
345	340	350	2.50	10.79	0.71	1.06
361	250	360	2.00	3.85	0.39	0.47
365	350	360	2.50	3.47	0.23	0.13
371	310	370	2.50	7.32	0.48	0.52
405	230	400	4.00	129.51	3.31	10.68
408	400	410	4.00	104.64	2.67	7.20
411	410	420	4.00	83.10	2.12	4.70
421	420	430	4.00	63.91	1.63	2.89
431	430	440	4.00	45.76	1.17	1.56

Page 5 Alternate Two, Development Option B, Includes proposed 6" on 60th Avenue

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
441	440	450	4.00	28.42	0.73	0.65
451	450	460	4.00	12.19	0.31	0.13
501	280	500	4.00	-43.11	1.10	1.40
511	500	510	6.00	92.49	1.05	0.80
515	510	480	6.00	45.05	0.51	0.21
471	400	470	2.00	6.71	0.69	1.31
521	410	520	2.00	3.39	0.35	0.37
481	470	480	2.00	-11.44	1.17	3.51
525	520	530	2.00	-14.76	1.51	5.62
531	480	530	6.00	52.80	0.60	0.28
551	540	550	4.00	20.47	0.52	0.35
541	530	540	6.00	38.43	0.44	0.16
561	550	560	4.00	-8.29	0.21	0.07
571	420	570	2.00	1.04	0.11	0.04
545	570	540	2.00	-17.11	1.75	7.39
581	430	580	2.00	-0.01	0.00	0.00
591	440	590	2.00	-0.81	0.08	0.03
555	580	550	2.00	-18.16	1.86	8.25
565	590	560	2.00	-18.97	1.94	8.93
601	560	600	4.00	-39.21	1.00	1.17
611	600	610	4.00	-73.74	1.88	3.77
621	450	620	2.00	-1.92	0.20	0.13
631	460	630	2.00	-5.97	0.61	1.05
635	630	610	2.00	-24.12	2.46	13.94
625	600	620	2.00	20.07	2.05	9.92
7	10	200	4.00	116.03	2.96	8.72
6	10	6	2.00	21.96	2.24	11.72
4	6	4	2.00	7.32	0.75	1.54
3	3	6	2.00	-7.32	0.75	1.54
1020	1010	1020	8.00	609.83	3.89	6.42
1030	1020	1030	8.00	591.68	3.78	6.07
1040	1030	1040	6.00	404.97	4.60	12.22
1052	500	1050	6.00	-135.60	1.54	1.61
1032	1030	660	4.00	109.80	2.80	7.87
1070	1050	1070	4.00	55.50	1.42	2.23
1072	1070	480	4.00	37.34	0.95	1.07
1082	1080	530	4.00	18.55	0.47	0.29
1090	1080	1090	4.00	-36.70	0.94	1.04
1102	1090	1100	4.00	-54.85	1.40	2.18
1050	1040	1050	6.00	209.25	2.37	3.60
1120	1110	1120	4.00	35.46	0.91	0.97
1122	1120	540	4.00	17.31	0.44	0.26
1045	1040	1100	4.00	177.57	4.53	19.15
1105	1100	1110	4.00	104.56	2.67	7.19
1150	1110	1150	4.00	50.94	1.30	1.90
1160	1150	1160	4.00	25.71	0.66	0.54

Page 6 Alternate Two, Development Option B, Includes proposed 6" on 60th Avenue

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft	
1162	1160	550	4.00	7.55	0.19	0.06	
1170	1150	1170	4.00	7.08	0.18	0.05	
1180	1170	1180	4.00	24.35	0.62	0.49	
1182	1180	560	4.00	6.20	0.16	0.04	
1190	1170	1190	4.00	-35.42	0.90	0.97	
1200	1190	1200	4.00	21.86	0.56	0.40	
1202	1200	600	4.00	3.70	0.09	0.01	
1210	1190	1210	4.00	-75.43	1.93	3.93	
1220	1210	1220	4.00	18.35	0.47	0.29	
1225	1220	610	4.00	0.20	0.01	0.00	
1230	1210	1230	4.00	-111.94	2.86	8.16	
1240	1230	1240	4.00	-21.63	0.55	0.39	
1250	1240	1250	4.00	-80.25	2.05	4.41	
1260	1240	1260	4.00	40.46	1.03	1.24	
1270	1260	1270	4.00	22.31	0.57	0.41	
1280	1250	1280	6.00	147.96	1.68	1.90	
1282	1280	1300	6.00	129.81	1.47	1.49	
1302	1300	1270	6.00	111.66	1.27	1.13	
1278	1270	610	6.00	115.81	1.31	1.21	
1310	1250	1310	6.00	-246.36	2.80	4.87	
1320	1310	1400	6.00	-282.67	3.21	6.28	
1330	1320	1330	4.00	104.17	2.66	7.14	
1332	1330	1340	4.00	86.02	2.20	5.01	
1328	1010	1320	8.00	423.15	2.70	3.26	
1350	1340	1350	4.00	-40.60	1.04	1.25	
1355	1030	1350	4.00	58.76	1.50	2.48	
1410	1310	1410	2.00	18.15	1.85	8.24	
1420	1320	1400	6.00	300.82	3.41	7.05	
1349	1340	1230	4.00	108.47	2.77	7.69	
231	230	510	6.00	-47.44	0.54	0.23	
1	1	5		309.80	15 hp	-192.75	Pump
1001	1000	1005		1032.98	51 hp	-194.45	Pump
9	5	10	4.00	309.80	7.91	0.00	PRV
1006	1005	1010	8.00	1032.98	6.59	0.00	PRV

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******************************************************************
*                         E P A N E T                            *
*                 Hydraulic and Water Quality                    *
*                 Analysis for Pipe Networks                     *
*                        Version 1.1e                            *
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Peak Irrigation Demand, Fire Flow, Build Out Commercial

```
  Input Data File ................... BOPT2A.INP
  Output Report File ................ BOPT2A.OUT
  Verification File .................
  Hydraulics File ...................
  Map File .......................... BOPT2A.MAP
  Number of Pipes ................... 121
  Number of Nodes ................... 99
  Number of Tanks ................... 2
  Number of Pumps ................... 2
  Number of Valves .................. 2
  Headloss Formula .................. Hazen-Williams
  Hydraulic Timestep ................ 1.00 hrs
  Hydraulic Accuracy ................ 0.001000
  Maximum Trials .................... 40
  Quality Analysis .................. None
  Specific Gravity .................. 1.00
  Kinematic Viscosity ............... 1.10e-05 sq ft/sec
  Chemical Diffusivity .............. 1.30e-08 sq ft/sec
  Total Duration .................... 0.00 hrs
  Reporting Criteria:
     All Nodes
     All Links
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Node Results:

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
3	87.00	7.68	208.77	52.76
4	87.00	7.68	208.74	52.75
5	87.00	0.00	210.66	53.58
6	87.00	7.68	208.93	52.83
10	87.00	7.68	210.66	53.58
20	86.00	7.68	204.09	51.17
30	89.00	7.68	203.48	49.61
40	84.00	7.68	203.64	51.84
50	82.00	7.68	203.35	52.58
60	92.00	7.68	203.47	48.30
70	84.00	7.68	203.15	51.63
80	87.00	7.68	202.10	49.87
90	82.00	7.68	201.71	51.87
100	83.00	7.68	202.09	51.60
110	85.00	7.68	202.10	50.74

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi
120	87.00	7.68	203.07	50.30
130	91.00	7.68	202.09	48.14
140	98.00	7.68	202.09	45.10
150	85.00	7.68	203.20	51.21
160	84.00	7.68	203.06	51.59
170	85.00	7.68	206.91	52.82
180	85.00	7.68	207.71	53.17
190	85.00	7.68	208.89	53.68
200	87.00	7.68	209.81	53.21
210	84.00	7.68	205.58	52.68
220	82.00	7.68	204.06	52.89
230	91.00	0.00	203.24	48.63
250	78.00	7.68	205.35	55.18
260	84.00	7.68	205.69	52.73
270	84.00	7.68	206.24	52.97
280	90.00	7.68	206.63	50.53
290	84.00	7.68	206.33	53.01
310	85.00	7.68	205.55	52.24
320	85.00	7.68	205.50	52.21
330	80.00	7.68	205.54	54.40
340	82.00	7.68	206.03	53.74
350	77.00	7.68	205.34	55.61
360	68.00	7.68	205.20	59.45
370	78.00	7.68	205.30	55.16
400	88.00	19.05	202.15	49.46
410	85.00	19.05	200.30	49.96
420	84.00	19.05	199.10	49.87
430	78.00	19.05	198.33	52.14
440	80.00	19.05	197.90	51.09
450	85.00	19.05	197.71	48.84
460	88.00	19.05	197.67	47.52
470	80.00	19.05	202.07	52.89
480	85.00	19.05	207.32	53.00
500	90.00	0.00	207.35	50.85
510	87.00	0.00	207.33	52.14
520	76.00	19.05	200.32	53.87
530	78.00	19.05	207.15	55.96
540	75.00	19.05	207.09	57.23
550	81.00	19.05	206.84	54.53
560	85.00	19.05	206.72	52.74
570	76.00	19.05	199.23	53.40
580	80.00	19.05	198.51	51.35
590	83.00	19.05	198.13	49.88
600	85.00	19.05	206.70	52.73
610	88.00	19.05	206.71	51.44
620	86.00	19.05	198.01	48.53

Node Results: (continued)

Node	Elev. ft	Demand gpm	Grade ft	Pressure psi	
630	89.00	19.05	198.44	47.42	
660	84.00	1000.00	207.87	53.67	
1005	85.00	0.00	212.30	55.16	
1010	85.00	0.00	212.30	55.16	
1020	84.00	19.05	209.91	54.56	
1030	83.00	19.05	208.25	54.27	
1040	82.00	19.05	208.00	54.60	
1050	86.00	19.05	207.91	52.82	
1070	90.00	19.05	207.65	50.98	
1080	89.00	19.05	207.15	51.20	
1090	84.00	19.05	207.18	53.38	
1100	83.00	19.05	207.72	54.04	
1110	84.00	19.05	207.60	53.56	
1120	87.00	19.05	207.44	52.19	
1150	85.00	19.05	207.34	53.01	
1160	85.00	19.05	207.21	52.95	
1170	86.00	19.05	207.22	52.52	
1180	85.00	19.05	207.09	52.90	
1190	84.00	19.05	207.18	53.37	
1200	89.00	19.05	207.06	51.16	
1210	80.00	19.05	207.18	55.11	
1220	83.00	19.05	207.07	53.76	
1230	79.00	19.05	207.19	55.55	
1240	75.00	750.00	205.32	56.47	
1250	75.00	19.05	208.56	57.87	
1260	80.00	19.05	205.38	54.33	
1270	90.00	19.05	206.73	50.58	
1280	80.00	19.05	207.74	55.35	
1300	99.00	19.05	206.99	46.79	
1310	69.00	19.05	209.47	60.87	
1320	17.00	19.05	209.97	83.62	
1330	72.00	19.05	209.04	59.38	
1340	78.00	19.05	208.19	56.41	
1350	83.00	19.05	208.22	54.26	
1400	71.00	19.05	209.81	60.15	
1410	68.00	19.05	208.05	60.68	
1	30.00	-329.97	30.00	0.00	Reservoir
1000	90.00	-2694.60	90.00	0.00	Reservoir

Link Results:

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
11	10	20	4.00	190.96	4.88	21.91
31	20	230	6.00	115.70	1.31	1.20
41	40	20	4.00	-67.58	1.73	3.21
51	40	50	2.00	7.68	0.78	1.68
61	40	60	2.50	5.27	0.34	0.28
71	40	70	4.00	46.95	1.20	1.63
81	70	80	2.00	8.19	0.84	1.89
101	100	90	2.00	7.68	0.78	1.68
91	80	100	2.00	0.87	0.09	0.03
111	110	80	2.00	0.36	0.04	0.01
121	110	120	2.00	-8.04	0.82	1.83
125	70	120	4.00	23.25	0.59	0.45
131	130	120	2.00	-7.53	0.77	1.62
141	70	140	2.00	7.83	0.80	1.74
145	140	130	2.00	0.15	0.02	0.00
161	100	160	2.00	-14.49	1.48	5.43
151	160	150	2.00	-5.62	0.57	0.94
171	170	150	2.00	13.30	1.36	4.64
181	180	170	4.00	85.25	2.18	4.93
191	190	180	4.00	92.93	2.37	5.78
201	200	190	4.00	100.61	2.57	6.69
35	30	60	2.50	2.41	0.16	0.07
211	170	210	2.00	8.30	0.85	1.94
221	220	210	2.50	-17.77	1.16	2.67
222	30	220	2.50	-10.09	0.66	0.94
251	160	250	2.00	-16.55	1.69	6.94
261	250	260	4.00	-27.66	0.71	0.61
271	260	270	4.00	-35.34	0.90	0.97
275	170	270	4.00	55.97	1.43	2.26
281	210	280	2.50	-17.16	1.12	2.50
292	270	290	4.00	-16.86	0.43	0.25
295	280	290	4.00	24.54	0.63	0.49
315	310	320	2.50	5.15	0.34	0.27
318	280	310	2.50	20.51	1.34	3.48
325	320	330	2.50	-2.53	0.17	0.07
335	340	330	2.50	10.21	0.67	0.96
341	270	340	4.00	29.82	0.76	0.71
345	340	350	2.50	11.93	0.78	1.28
361	250	360	2.00	3.43	0.35	0.38
365	350	360	2.50	4.25	0.28	0.19
371	310	370	2.50	7.68	0.50	0.57
405	230	400	4.00	115.70	2.95	8.67
408	400	410	4.00	94.77	2.42	5.99
411	410	420	4.00	76.41	1.95	4.02
421	420	430	4.00	59.83	1.53	2.56
431	430	440	4.00	43.67	1.11	1.43

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft
441	440	450	4.00	27.92	0.71	0.62
451	450	460	4.00	12.69	0.32	0.15
501	280	500	4.00	-69.89	1.78	3.41
511	500	510	6.00	29.59	0.34	0.10
515	510	480	6.00	29.59	0.34	0.10
471	400	470	2.00	1.88	0.19	0.12
521	410	520	2.00	-0.69	0.07	0.02
481	470	480	2.00	-17.16	1.75	7.43
525	520	530	2.00	-19.74	2.02	9.62
531	480	530	6.00	75.66	0.86	0.55
551	540	550	4.00	32.59	0.83	0.83
541	530	540	6.00	44.04	0.50	0.20
561	550	560	4.00	21.49	0.55	0.39
571	420	570	2.00	-2.46	0.25	0.20
545	570	540	2.00	-21.51	2.20	11.28
581	430	580	2.00	-2.89	0.29	0.27
591	440	590	2.00	-3.29	0.34	0.35
555	580	550	2.00	-21.93	2.24	11.69
565	590	560	2.00	-22.34	2.28	12.10
601	560	600	4.00	9.75	0.25	0.09
611	600	610	4.00	-5.03	0.13	0.03
621	450	620	2.00	-3.82	0.39	0.46
631	460	630	2.00	-6.36	0.65	1.18
635	630	610	2.00	-25.40	2.59	15.34
625	600	620	2.00	22.86	2.33	12.62
7	10	200	4.00	108.29	2.76	7.67
6	10	6	2.00	23.04	2.35	12.81
4	6	4	2.00	7.68	0.78	1.68
3	3	6	2.00	-7.68	0.78	1.68
1020	1010	1020	12.00	1681.30	4.77	5.82
1030	1020	1030	12.00	1662.25	4.72	5.70
1040	1030	1040	12.00	576.35	1.63	0.80
1052	500	1050	6.00	-99.48	1.13	0.91
1032	1030	660	10.00	1000.00	4.08	5.41
1070	1050	1070	6.00	101.32	1.15	0.94
1072	1070	480	6.00	82.27	0.93	0.64
1082	1080	530	6.00	7.17	0.08	0.01
1090	1080	1090	6.00	-26.21	0.30	0.08
1102	1090	1100	4.00	-45.26	1.16	1.53
1050	1040	1050	12.00	219.84	0.62	0.13
1120	1110	1120	6.00	48.16	0.55	0.24
1122	1120	540	4.00	29.11	0.74	0.68
1045	1040	1100	8.00	337.46	2.15	2.15
1105	1100	1110	8.00	273.16	1.74	1.45
1150	1110	1150	8.00	205.95	1.31	0.86
1160	1150	1160	6.00	48.92	0.56	0.24

Link Results: (continued)

Link	Start Node	End Node	Diameter in	Flow gpm	Velocity fps	Headloss /1000ft	
1162	1160	550	4.00	29.88	0.76	0.71	
1170	1150	1170	8.00	137.98	0.88	0.41	
1180	1170	1180	6.00	48.69	0.55	0.24	
1182	1180	560	4.00	29.64	0.76	0.70	
1190	1170	1190	8.00	70.25	0.45	0.12	
1200	1190	1200	6.00	46.18	0.52	0.22	
1202	1200	600	4.00	27.13	0.69	0.59	
1210	1190	1210	8.00	5.02	0.03	0.00	
1220	1210	1220	6.00	44.78	0.51	0.21	
1225	1220	610	4.00	25.74	0.66	0.54	
1230	1210	1230	8.00	-58.81	0.38	0.08	
1240	1230	1240	6.00	346.76	3.93	9.17	
1250	1240	1250	6.00	-369.25	4.19	10.30	
1260	1240	1260	6.00	-33.99	0.39	0.12	
1270	1260	1270	4.00	-53.04	1.35	2.05	
1280	1250	1280	6.00	133.92	1.52	1.58	
1282	1280	1300	6.00	114.87	1.30	1.19	
1302	1300	1270	6.00	95.83	1.09	0.85	
1278	1270	610	6.00	23.74	0.27	0.06	
1310	1250	1310	10.00	-522.21	2.13	1.63	
1320	1310	1400	10.00	-560.30	2.29	1.85	
1330	1320	1330	8.00	414.90	2.65	3.15	
1332	1330	1340	8.00	395.86	2.53	2.89	
1328	1010	1320	12.00	1013.30	2.87	2.28	
1350	1340	1350	8.00	-47.81	0.31	0.06	
1355	1030	1350	10.00	66.85	0.27	0.04	
1410	1310	1410	2.00	19.05	1.95	9.01	
1420	1320	1400	10.00	579.35	2.37	1.97	
1349	1340	1230	8.00	424.62	2.71	3.29	
1	1	5		329.97	15 hp	-180.66	Pump
1001	1000	1005		2694.60	83 hp	-122.30	Pump
9	5	10	4.00	329.97	8.42	0.00	PRV
1006	1005	1010	12.00	2694.60	7.64	0.00	PRV

Appendix B

Appendix "B"

Opinion of Estimated Probable Construction Costs

Alternative One

Description	2005 Dollars
New 12" well and pump	65,000
Two 12,000 gal hydropneumatic tanks	60,000
Yard piping	20,000
Chlorination system	12,000
Electrical	75,000
Testing	2,000
Control/pump building	30,000
Site work	10,000
Engineering	33,000
Permits (FDEP and SWFWMD)	10,000
Replace existing tank w/7,500 gal tank	30,000
Land	400,000
TOTAL	$747,000

Alternative Two-A

Description	2005 Dollars
New 10" well and 15 Hp pump	50,000
0.3 million gal storage tank	150,000
Hi-service pumping system	65,000
Yard piping	80,000
Chlorination system	12,000
Electrical	100,000
Testing	2,000
Control/pump building	50,000
Site work	14,000
Engineering	63,000
Permits (FDEP and SWFWMD)	10,000
Replace existing tank w/7,500 gal tank	30,000
Land	400,000
TOTAL	$1,026,000