ABSTRACT

DESIGN AND TESTING OF A SUBSURFACE EXCESS IRRIGATION CAPTURE AND RE-USE SYSTEM

By

Kathryn Harrel

August 2015

In January 2014, the California Governor declared a drought state of emergency and directed officials to take action to prepare for future water shortages. Many urban communities in California have shown great efforts in reducing water consumption and conserving water. Meanwhile, various residential communities take pride in the natural and green environment provided to their residents and without water for irrigation, fear a decrease in aesthetic appeal. In an effort to conserve water without giving up irrigation, this thesis takes a closer look at a subsurface irrigation and collection system that could reduce the use of potable water for irrigation in the range of 15 to 30 percent.

Initial concepts were developed and tested through various potential design models. An extensive literature review was performed. The design criteria and methodology for an infiltration trench was used along with the results from the potential design models as the basis for the subsurface irrigation collection system design. The

goal was to create a system beneath the lawn vegetation that would contribute to water conservation through reuse.

A laboratory prototype was constructed and tested in a laboratory. The findings were translated into a design for the American Gold Star Manor (Manor) which was constructed and tested. The complete system at the Manor has an average capture efficiency of 9 percent.

An analysis was performed for which the cost and benefit was assessed for the system at the Manor assuming different capture efficiencies were achieved and the system was implemented over a larger area. This analysis was performed assuming different volumes of water are used to irrigate, one based on the Environmental Protection Agency (EPA) water budget tool and the other using historical data from the Manor. The analysis demonstrated that with 20 percent capture efficiency, a system implemented over a one acre area would pay itself off in 1,444 years under the EPA irrigation assumption and 347 years under the historical use assumption.

To evaluate potential modifications to the system constructed at the Manor, Hydrus 2D/3D, a software package for simulating water movement in variably saturated media, was used to assess various alternatives. Varying media ratios, depths, and irrigation frequencies were modeled and relationships were developed.

DESIGN AND TESTING OF A SUBSURFACE
EXCESS IRRIGATION CAPTURE
AND RE-USE SYSTEM

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Committee Members:

Antonella Sciortino, Ph.D (Chair)
Rebeka Sultana, Ph.D
Ben Willardson, Ph.D

College Designee:

Antonella Sciortino, Ph.D.

By Kathryn Harrel

B.S., 2013, California State University, Long Beach

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TABLE OF CONTENTS

CHAPTER Page

Page

LIST OF TABLES

TABLE Page

TABLE Page

LIST OF FIGURES

FIGURE Page

LIST OF ABBREVIATIONS

ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BMP	Best Management Practice
BOD	Biological Oxygen Demand
CASQA	California Stormwater Quality Association
CEO	Chief Executive Officer
COD	Chemical Oxygen Demand
CSULB	California State University Long Beach
DAMP	Drainage Area Management Plan
EPA	Environmental Protection Agency
HSG	Hydrologic Soil Group
LACDPW	Los Angeles County Department of Public Works
MWD	Metropolitan Water District
PVC	Polyvinyl Chloride
SUSMP	Standard Urban Stormwater Mitigation Plan
TRSIS	Tailwater Recovery and Seepage-Interception System
UWOT	Urban Water Optioneering Tool
WQV	Water Quality Volume

CHAPTER 1

INTRODUCTION

In January 2014, the California Governor declared a drought state of emergency and directed officials to take action as necessary to prepare for future water shortages. In response to the current drought conditions, many urban communities in California have shown great efforts in reducing water consumption and conserving water. Meanwhile, various residential communities take pride in the natural and green environment provided to their residents and without water for irrigation, fear a decrease in aesthetic appeal. In an effort to conserve water without giving up irrigation, this thesis takes a closer look at potential solutions and evaluates associated theories. It is hypothesized that a subsurface irrigation collection system could reduce the use of potable water for irrigation in the range of 15 to 30 percent.

To address the hypothesis, literature has been reviewed and a series of prototypes have been developed and tested. Starting in 2012 with a grant from the Metropolitan Water District (MWD), research began to develop subsurface irrigation collection system concepts. At that point (2012), the American Gold Star Manor (Manor), a local senior housing community for low-income veterans and mothers of fallen soldiers, offered support and a portion of their site for development and testing. Initially, designs were developed and tested through various small-scale design models. Once the potential designs were evaluated, a literature review was performed which focused on water recycling systems and infiltration trenches as stormwater Best Management Practices (BMPs). The concept of utilizing a media that provides additional void space as a form of storage was translated and modified to fit the situation at the Manor. The design criteria and methodology for an infiltration trench was used as a basis for the subsurface irrigation collection system design. The goal was to create a system beneath a lawn area that would collect surplus water and re-use it to contribute to water conservation.

The findings from the potential design models, along with the information gathered through the literature review, served as the basis for the laboratory prototype which was constructed and tested in the California State University, Long Beach (CSULB) Fluid Mechanics Laboratory. The findings from the laboratory were translated into a design for the Manor which was constructed and tested at the site. Through the development and testing process, the hypothesis was evaluated. Based on findings from the on-site system, modifications have been considered, which would further increase the efficiency of the system and contribute to greater water conservation. To evaluate these recommendations, Hydrus 2D/3D, a software package for simulating water, heat, and solute movement in two- and three-dimensional variably saturated media was used. The calibrated model was used to evaluate potential system modifications that may be further considered in the future. Through the development and progression of this thesis, the original hypothesis has been supported and a subsurface excess irrigation collection and re-use system can reduce the use of potable water in the range of 15 to 30 percent depending on the volume of water used to irrigate. However, the efficiency is heavily reliant on the volume of water applied to the system. The following is an outline of the topics covered in the following chapters:

Chapter 1: Introduction — provides an overview of the thesis concept, goals, and methodology.

Chapter 2: Background — discusses the background information relevant to the system development and construction.

Chapter 3: Literature Review — provides an extensive literature review that focuses on water recycling systems and the theories and design criteria relevant to infiltration trenches as a stormwater BMP, both of which serve as the basis of design for the subsurface irrigation collection system.

Chapter 4: Initial Prototypes — presents the development, construction, and testing of the potential design models and laboratory prototype, which contribute to the final field design for the Manor. The soil characteristics at the Manor were evaluated and the findings are presented in this chapter.

Chapter 5: Site Design — summarizes the design, construction, and testing relevant to the final design at the Manor.

Chapter 6: Projections — evaluates large scale implementation of the system throughout the Manor. This section evaluates the cost and benefit of implementing the system at various scales.

Chapter 7: System Modeling — presents the model development and summarizes the results from various model alternatives.

Chapter 8: Future Studies and Recommendations — discusses the future studies that are recommended based on the findings from this research.

CHAPTER 2

BACKGROUND

The “International Decade of Fresh Water” (2005 to 2015) was proclaimed by the United Nations to raise awareness about global water issues. The MWD, along with the United States Bureau of Reclamation, Friends of the United Nations, the Sanitation Districts of Los Angeles County, and Water for People, fund the World Water Forum, a grant program that promotes the research and development on the implementation of water-use efficiency technology, policy research, and communication strategies for implementation in Southern California, internationally, or in developing nations. The hopes of this program are to create new water conservation technologies, policies, and/or communication programs that will result in generating student interest in engineering, environmental science, and related careers in the water industry, while promoting economic and workforce development in Southern California. During the 2012 calendar year, fifteen teams made up of students and faculties from colleges in Southern California were awarded $10,000 grants.

A team of CSULB students and faculty were awarded with the grant. The project concept awarded through the World Water Forum provided a foundation for this thesis.

2.1 Project Concept

The goal of this research was to develop a water conservation prototype that would improve current technology for water recycling and treatment. The study aimed to create an integrated system that combines efficient landscape and site design with a rainfall and gray water collection and treatment system for re-use in landscape irrigation coupled with a subsurface drainage system to capture and recycle the irrigation surplus water. A schematic of the proposed system is provided in FIGURE 1.

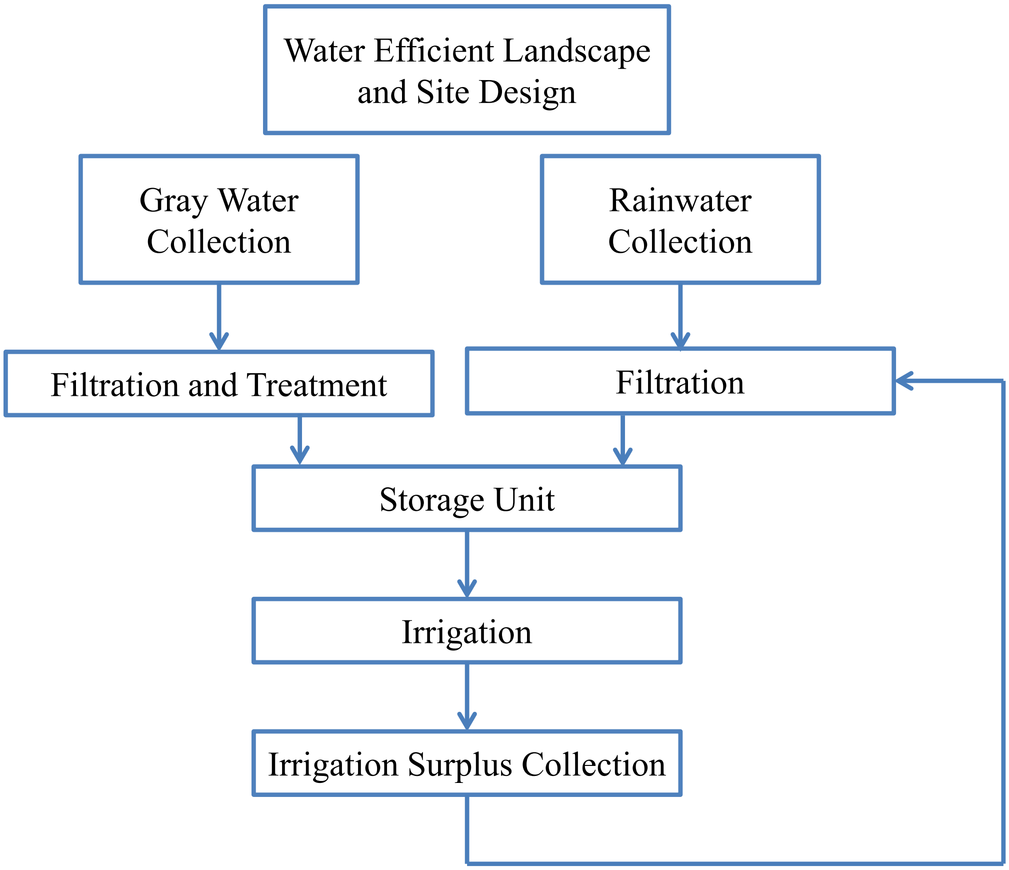


FIGURE 1. Schematic of proposed system.

It was conceptualized that this study would incorporate a system that would collect surface and subsurface flows generated from a rain event or resulting from excess irrigation, utilizing an underground collection system. A second system would also be incorporated that would collect and treat gray water from a residential building through a filtration unit. Gray water is defined as untreated wastewater that has not come into contact with toilet waste, which includes water from bathtub showers, sinks, and washing machines. The outflow from the two systems would be collected in a storage tank and would be used to irrigate the newly landscaped area.

As part of this study, a pilot design was built and tested in the field. The results obtained through the study were employed to estimate the feasibility of extending the proposed system to the entire residential complex. The projections may also apply to other projects at the municipal or regional level. The three main components of the system include: water conserving landscape and site design; water harvesting and treatment of surface stormwater and gray water; and subsurface surplus irrigation and rainwater collection.

2.1.1 Water Conserving Landscape and Site Design

The research started with a detailed soil investigation and documentation of the existing site conditions. The initial site investigation included retrieving soil samples from the site and measuring relevant soil properties according to the American Society for Testing and Materials (ASTM) standard procedures. Permeability tests were performed in the CSULB Fluids Laboratory to determine the hydraulic conductivity.

Additionally, a water conserving landscape was designed by a landscape architect for the entire site (not limited to the area within which the pilot project took place).

2.1.2 Water Harvesting and Treatment of Surface Stormwater and Gray Water

The original concept for the water re-use system to be built on site included the collection of gray water from a residential building on-site, specifically from the laundry facility. It was anticipated that chemical treatment would not be necessary as the expected concentrations of hazardous chemical compounds is generally insignificant and below the plant tolerance limit. A filter would be designed and tested in the CSULB Fluids Laboratory and the efficiency would be based on the following data collected at the outlet of the filter: filtration rate; influent and effluent turbidity; and volume of removed suspended particles.

In terms of gray water, it was anticipated that the project would include the collection from the laundry rooms in one of the residential buildings on-site through a system of pipelines constructed only for this purpose. To determine the most efficient filtration process for the gray water, two systems were built for testing, one based on membrane technology and the other based on nanoscale titanium dioxide. The efficiency of the two systems was analyzed based on measuring Chemical Oxygen Demand, Biological Oxygen Demand, and alkalinity with a pH meter. Once the gray water was treated, it would be combined and stored in an underground tank for irrigation use. This aspect was beyond the scope of the present study and it is not reported in this thesis.

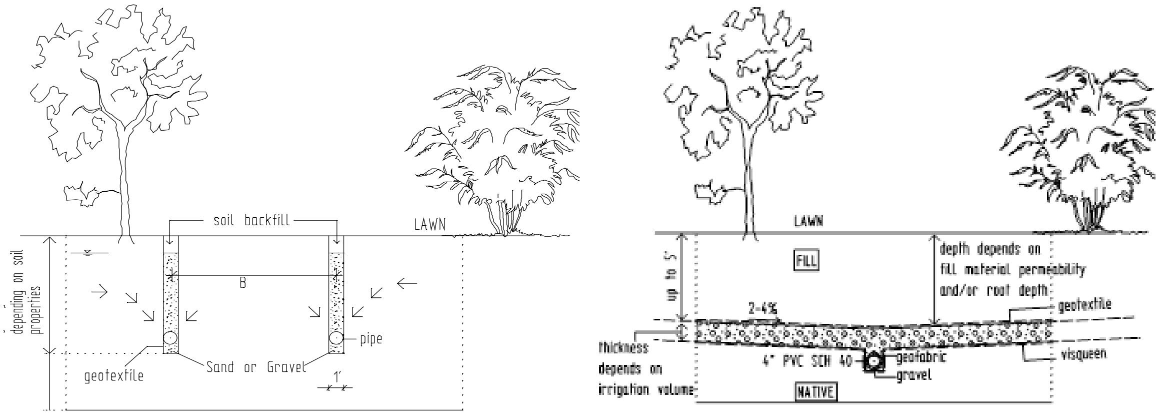
2.1.3 Subsurface Surplus Irrigation and Rainwater Collection

A similar study was previously conducted at CSULB concerning a related topic. FIGURE 2 demonstrates the schematic of the two systems developed and tested during the previous study. As demonstrated in FIGURE 2(a), the low permeability soils require a trench collection system. The trenches are filled with a highly permeable material and spaced throughout the project site so that surface and subsurface drainage is guided to a trench, allowing easier flow collection. A slotted pipe is placed at the bottom of each trench and the various trench drain systems are connected so that all the water is eventually transported to the filtration unit or underground tank. In cases where highly permeable soils exist, a blanket drain system may be used as the water drains rapidly and the blanket drain would serve as an interceptor for the infiltrated water, as demonstrated in FIGURE 2(b). The blanket drain is a continuous layer built underground, guaranteeing complete spatial coverage to maximize collection yield. A slotted pipe would also be used in this system to convey flows to the filtration unit or underground tank. These concepts were further investigated during the research and development phases of this study.

2.2 American Gold Star Manor

One of the components of this study that makes it unique is the site at which the system was constructed. The system developed as part of this study was built at the American Gold Star Manor in Long Beach. The Manor was founded by the American Gold Star Mothers in 1928. This organization is made up of a group of women who lost sons and daughters during their service in the United States Armed Forces. American

Gold Star Homes were built for the purpose of providing a national home for the members of the American Gold Star Mothers. By 1973, the number of residents had outgrown the homes, requiring the replacement of the homes, resulting in the Manor.



(a) Low Permeability (b) High Permeability Soils

FIGURE 2. Subsurface surplus irrigation and rainwater collection system schematic.

The complex currently consists of nine three-story units and one two-story unit with a total of 348 apartments. All of the buildings are located in a quiet section of Long Beach. This secure 23-acre park like setting near the intersection of Spring Street and Santa Fe Avenue is shown in FIGURE 3 from Google imagery. Each apartment has its own kitchen and each building has its own laundry room. Due to facility aging, management has decided to undertake major renovations which were anticipated to have started as early as spring of 2012, but were delayed until early 2015. The renovations will be completed over the next few years. The renovation includes remodeling of the interiors, replacing the water and wastewater pipes, and replacing eight or more acres of turf with water efficient landscaping. The timing of the renovations made the Manor an ideal project site. Terry Geiling, the Manor Chief Executive Officer was supportive of the study which would provide the organization with a water efficient system to reduce irrigation water costs and achieve the organization's goals in an environmentally sensitive fashion.

Currently, the Manor utilizes potable water from the Long Beach Water District for its residential and landscape irrigation needs. The management team at the Manor conducted an analysis that estimated an average water use of 24,208,272 gallons of potable water per year. Approximately 10,151,856 gallons per year were used for irrigation only each year from 2006 to 2010. The goal of the study was to provide a system that would maximize water conservation and reduce water costs for this low-income senior housing community.

2.3 Anticipated Outcomes and Benefits

When this study started, the anticipated project benefits included water conservation, reduction of water treatment costs, improvement of the environment, and sustainability benefits for the residents. The study mostly intended to conserve water, with a goal of reducing the amount of potable water purchased and used for irrigation. Utilizing rainfall and gray water recycling, along with efficient landscape design, would result in significant savings in potable water, which would not only conserve water within Los Angeles County, but also decrease the potable water bill for the housing community within the Manor. The incorporation of gray water would also decrease the amount of waste, as it would be recycled and used. In addition to small scale water conservation benefits, the project could also have global implications, as the project could be applicable in many different communities within California, the United States, and the world.

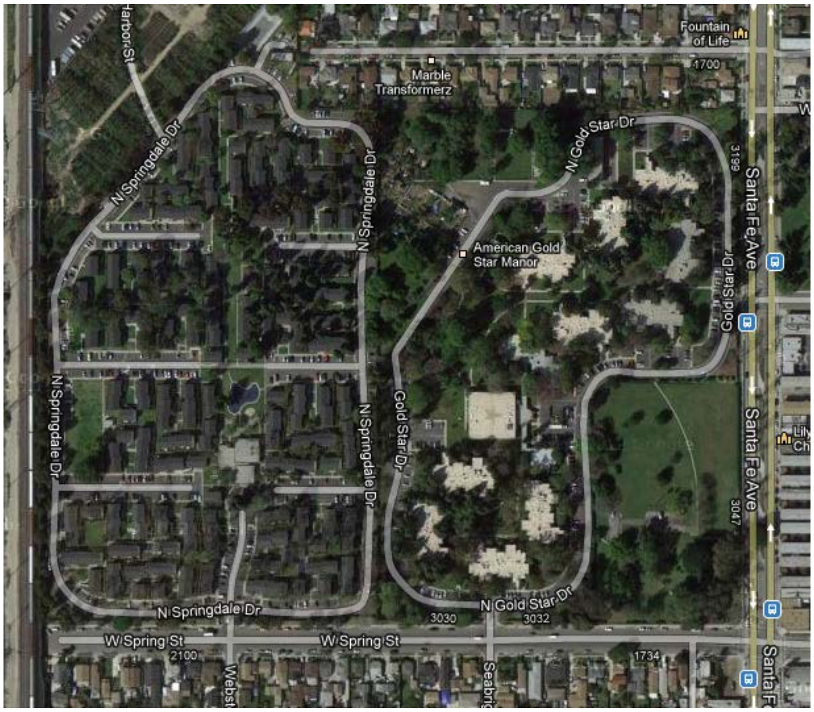


FIGURE 3. American Gold Star Manor aerial photograph (www.maps.google.com).

Another goal of the study was an improvement of the environment and sustainability benefits for people. Through use of native drought resistant plants, a water recycling system (including both surplus irrigation and gray water), and a rainfall capture and re-use system, the concept promoted a sustainable landscaped environment that would contribute to improved quality of life for the people living at the Manor. It would be rewarding for the community to contribute to a more sustainable environment.

CHAPTER 3

LITERATURE REVIEW

The literature review performed for this study pertains mainly to water recycling and water efficiency, as this broad concept relates with the goals of this project. Additionally, literature regarding tailwater collection and use, an irrigation practice often used in agricultural applications, was reviewed. Finally, literature that discusses infiltration trenches was also reviewed. The information gathered through literature served as the basis for the design of the subsurface collection system at the site.

3.1 Water Efficiency and Recycling

The goal of the system constructed at the Manor is to reduce potable water demand by creating a more efficient way of maintaining landscaping. This section describes different aspects of water recycling and efficient water use and how they relate to the system designed for the Manor.

Rozos et al. (2010) discussed the design robustness of local water-recycling schemes. The authors looked into sustainable design and implementation of different water recycling systems within varying climatic conditions (oceanic, Mediterranean, and desert). The study focused on two types of systems, one that solely utilized stormwater and the other that used both stormwater and gray water.

The urban water optioneering tool (UWOT), a decision support tool that simulates the urban water cycle by modeling individual water uses and technologies was discussed. The tool takes into consideration different levels of water use including, but not limited to, toilets, washing machines, and water using appliances. As previously mentioned, two systems were evaluated. The first assumes that harvested rainfall is collected and stored in a local tank and used for toilet flushing, washing machine, and outside uses with other water demands being supplied by potable water. The second scheme assumes that harvested rainwater and gray water from the shower, bath, and sink are collected, treated, and locally stored and used for the same applications as the first system, thus the potable water demand would decrease.

UWOT was used to optimize the systems regarding cost and reduction of potable water demand. The results demonstrated that in a desert region the maximum achievable potable demand reduction is less than 3 percent which can be achieved with a 55 percent increase in capital cost regarding the first scheme. For comparison, in an oceanic climate a reduction in potable water demand of 30 percent can be achieved with a capital cost increase of 64 percent. For the second system, it was found that the potable water demand could be reduced by more than 42 percent in all climates. The journal explains that the addition of gray water as part of the water recycling system has extreme benefits, especially in desert environments. These findings are consistent with the environment in which the systems were developed, as desert regions receive little rain so systems relying only on rainwater harvesting are likely to be insignificant.

The authors conclude that water recycling contributes to reduced potable water demand. It was also concluded that recycling water from a potable water source in addition to stormwater is especially important in a desert climate, like the climate on site. The system constructed at the site recycles a potable water source (irrigated water) and can also capture stormwater. Based on the configuration used at the site, the system is more efficient than if it were to only collect stormwater to supplement potable water demand. Capturing both stormwater and non-potable water made the system more efficient as was shown by the results of the UWOT. Incorporating gray water would further increase the success of the system.

Anderson (1996) describes various water recycling initiatives in Australia and the corresponding reductions in potable water demand that result from them. The author points out that recycling reclaimed water and stormwater for residential non-potable uses such as toilet flushing and irrigation has the potential to reduce residential demands by an average of 40 to 50 percent depending on the climate. These findings are similar to Rozos et al. (2010) who found that recycling systems that use stormwater and non-potable water could reduce potable water demand around 42 percent. He also found that recycling reclaimed water and stormwater for all uses including potable uses has the potential to reduce urban and industrial demands by amounts varying from 40 to 100 percent, also dependent on rainfall and climate.

Based on this article, the system at the site has the potential of reducing potable water demand in the range of 15 to 30 percent as hypothesized. The system at the site was designed to collect stormwater, but mainly to collect excess subsurface irrigation.

This system is comparable to the system Anderson (1996) describes in which both reclaimed water and stormwater are collected. However, the climate at the site is different than that found in Australia and is much drier, therefore the demand for potable water for irrigation is likely much greater.

Al-Hamaiedeh (2010) evaluated the potential public health risks associated with gray water reuse for irrigation. This topic is important, as the use of gray water for irrigation may be one solution to relieving the pressure on water scarcity issues in Jordan and in Southern California. Gray water collection was discussed for the system at the site, but not utilized as part of this study. In the future this may be an important component, thus the safety has been evaluated. As part of Al-Hamaiedeh's (2010) study, samples of gray water were collected and analyzed and surveys were distributed to households where gray water was and was not used for irrigation to assess the impacts on public health.

Treated gray water samples were collected from five households that used gray water for irrigation. The samples were analyzed per the local thresholds (Jordanian standards) using accepted testing methods for E. Coli, cadmium, lead, chromium, nickel, arsenic, and zinc. Results showed that some heavy metals and pathogenic indicators exceeded the local allowable limits. Chromium and nickel were found at levels exceeding local thresholds while lead and zinc were not. E. Coli concentrations were found to be above the local threshold and this was attributed to the absence of disinfection techniques that are used for bacteria removal.

Surveys were distributed to help determine if water borne diseases were related to gray water reuse for irrigation, using diarrhea as an indicator. The diarrhea cases in files from families using gray water irrigation did not differ from those using fresh water for irrigation. More than 90 percent of the survey respondents indicated that the use of gray water for irrigation has positively contributed to their socio-economic lifestyles. Fifty-three percent of the survey respondents suffered from an odor problem and 21 percent suffered from fly problems. These issues are most likely attributed to improper maintenance and upkeep.

This study demonstrates that there is not an obvious negative impact on public health and safety due to gray water reuse for irrigation. Using a better disinfection and treatment process could reduce the public health risk. Additionally, odor and fly problems may be eliminated through proper maintenance and disposal of sludge produced. This study also demonstrated that helping the environment or being in a setting that contributes to environmental wellbeing positively contributes to societal welfare. Based on the findings of this study, the system at the Manor will provide benefits to the residents in addition to decreasing potable water demand.

3.2 Tailwater Collection and Recycling

Tailwater refers to water located immediately downstream from a hydraulic structure. It often refers to runoff resulting from agricultural irrigation where water is applied in excess of the infiltration capacity. In agricultural practices, tailwater is often collected and recycled. This section discusses literature associated with this practice as the concept is similar to that at the site, being that it is a system that collects excess irrigation for recycling.

Schwankl et al. (2007) detail tailwater and its application in an agricultural setting. According to the authors, there are various ways of addressing the excess irrigation that is produced as tailwater in an agricultural setting. This water can be addressed through collection, disposal, and/or recycling. Schwankl et al. (2007) highlighted the following:

1. Block the ends of the irrigated rows with berms, allowing the water to pond on the tail end of the field. This method could lead to crop damage at the tail end due to standing water or due to lack of irrigation.

2. Tailwater is allowed to flow into the tail end of adjacent unirrigated furrows, used mostly when there is a minimal slope.

3. Tailwater is allowed to run off the field and discharge in natural water ways.

4. Ponds are used to collect tailwater and facilitate infiltration or evaporation. When this method is used the volume of irrigation must be related to the capacity of the collection pond.

5. Ponds are used to collect tailwater that is pumped and reused. This method, when used properly, maximizes irrigation efficiency and minimizes environmental impacts.

TABLE 1 summarizes the advantages and disadvantages of using tailwater collection and return systems in an agricultural setting according to Schwankl et al. (2007).

TABLE 1. Advantages and Disadvantages of Tailwater Return Systems

Advantages	Disadvantages
➢ Minimizes environmental impact ➢ Increase irrigation efficiency ➢ Reduces water costs ➢ Simplifies irrigation water management for systems that do not have a natural outlet ➢ Removes standing water that can lead to crop loss or vector breeding	➢ Increased capital, operation, and maintenance costs ➢ Loss of crop land due to storage pond ➢ Requires timely recycling of tailwater to prevent groundwater pollution

The authors also discuss the design components important to tailwater collection and recycling systems. As a rule of thumb, it is expected that the tailwater volume is equivalent to 15 to 25 percent of the water applied as irrigation. The major design component relates to the size of the pond, pump, return pipe, and power unit. This journal demonstrates the applicability of irrigation collection and recycling systems on a large scale.

Bethune and Smajstrla (2001) discussed a subsurface tailwater collection system used in an agricultural setting. The tailwater recovery and seepage-interception system (TRSIS) was installed at a farm in Florida. The system was moved below the ground in hopes of reducing the amount of space lost for crop production. This method of tailwater capture and reuse is very similar to that at the Manor in that they are both subsurface irrigation collection systems.

The TRSIS included perforated drain-tube installed along the bottom of the field in lieu of a conventional drainage ditch. Specialized laser-guided equipment was used to maintain design tolerance. The depth of the drain-tube varied between 2.8 and 1.9 feet deep. Following the construction of the TRSIS, six observation wells were used to record and assess the success of the system. The system was calibrated and tested for 77 days. It was found that the increase in the effective irrigation efficiency, defined as the overall irrigation efficiency corrected for water recovered and reused, was estimated to be 5 percent.

The system Bethune and Smajstrla (2001) describe is very similar to the one at the site, especially in theory. The subsurface tailwater collection system and the system at the site both are irrigated and then as the water infiltrates it travels through the subsurface media and is collected through a pipe system for reuse. The system at the site is of a much smaller scale and the flows have to be collected throughout the irrigated area as opposed to the application described in Bethune and Smajstrla (2001) study for which excess irrigation was conveyed on the surface to a low area and infiltrated. The system at the site utilizes a series of subsurface pipes while this system used one main collection pipe. In agricultural irrigation practices, excess irrigation is often conveyed to the low area located on one side of the irrigated crop land. At the site, there is no significant slope to contribute to water collection and rather flows must be collected throughout the entire system.

3.3 Infiltration Trenches

Many counties in Southern California have identified subsurface infiltration trenches as a BMP for addressing stormwater quality, and typical design features are incorporated in various BMP design manuals and guidelines. The following section reviews different BMP design manuals, handbooks, and guidelines pertaining to infiltration trenches. It is important to keep in mind that infiltration trenches are similar, but in this thesis, the subsurface trench system would be used to collect flows rather than infiltrate them. The following Southern California design manuals and handbooks were reviewed: 2002 Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP) Manual (LACDPW 2002); 2009 Los Angeles County Department of Public Works (LACDPW) BMP Design and Maintenance Manual (LACDPW 2009); 2003 California Stormwater Quality Association BMP Handbook (CASQA 2003); and 2011 Riverside County BMP Handbook (Riverside County Flood Control and Water Conservation District 2011).

Appendix B, Section B.8 in the LACDPW SUSMP Manual (2002) provides BMP design criteria for infiltration trenches. This manual defines an infiltration trench as “an excavated trench that has been lined with filter fabric and backfilled with stone to form an underground basin.” Infiltration trenches effectively remove soluble and particulate pollutants while providing groundwater recharge. The Los Angeles County SUSMP Manual recommends using infiltration trenches for drainage areas less than ten acres. TABLE 2 identifies the advantages and disadvantages of infiltration trenches according to the SUSMP Manual (LACDPW 2002).

The Los Angeles County SUSMP Manual (LACDPW 2002) identifies an abundance of limitations that must be taken into account when designing an infiltration trench using their methodology. The notable design criteria are summarized as follows: slopes of contributing watersheds need to be less than 20 percent; soils should have infiltration rates greater than 0.3 inches per hour and clay content less than 30 percent; inverts should be at least four feet above the underlying bedrock and seasonal high groundwater tables; trenches cannot be located within 100 feet of drinking water wells; trenches should be sited a minimum of ten feet down gradient and 100 feet up gradient from building foundations because of seepage problems; and depths should range between three and eight feet.

TABLE 2. Advantages and Disadvantages Based on LACDPW SUSMP Manual (2002)

Advantages	Disadvantages
➢ Promotes groundwater recharge	➢ Only feasible on permeable soils
➢ Fits in small areas	➢ Only feasible where water table and bedrock are situated deep beneath the surface
➢ Pollutant removal capabilities	➢ Often require pretreatment to prevent clogging
➢ Minimize/control peak runoff volume	➢ High failure rates and high maintenance burden
➢ Treats drainage areas from one to ten acres	➢ Risk of groundwater contamination in very coarse soil
	➢ Metals and petroleum hydrocarbons could accumulate in soils to potentially toxic levels

The LACDPW BMP Design and Maintenance Manual (2009) defines an infiltration trench as “long, narrow, rock-filled trenches that receive stormwater runoff from small drainage areas. These facilities may include a shallow depression at the surface, but the majority of runoff is stored in the void space between the stones and infiltrates through the sides and bottom of the trench.” (LACDPW 2009). The manual recommends pretreatment BMPs, such as swales, filter strips, and sediment forebays that minimize sediment loads to infiltration facilities to increase longevity and reduce the maintenance burden. The advantages and disadvantages identified in the manual are summarized in TABLE 3.

TABLE 3. Advantages and Disadvantages Based on the LACDPW BMP Design and Maintenance Manual (2009)

Advantages	Disadvantages
➢ Provides hydromodification control ➢ Removes fine sediment, particulate bound pollutants, and bacteria ➢ Removes pollutants through sedimentation, filtration, and adsorption	➢ Clogs more easily if pretreatment BMPs are not utilized ➢ Not feasible at industrial sites where hazardous material spills may occur ➢ Maintenance may be required relatively frequently

The LACDPW BMP Design and Maintenance Manual (2009) identifies limitations that must be taken into account when designing an infiltration trench using their methodology. The notable design criteria are summarized as follows: minimum infiltration rate of 0.5 inches/hour is required and if the infiltration rate exceeds 2.4 inches/hour then the runoff should be fully treated upstream; groundwater separation must be at least ten feet from the trench bottom and at least 100 horizontal feet from any drinking water wells; sites with a slope that exceeds 4:1 (25 percent) shall be excluded and sites with a slope greater than 15 percent require a geotechnical analysis; facility must not be located within 15 feet of a 2:1 or greater slope without a geotechnical investigation; minimum setback of 100 feet from septic system drain fields and drinking water wells; minimum setback of 8 feet from any structural foundation; maximum drawdown time of 72 hours; minimum width of two feet; preferred depth between three and five feet; and longitudinal slope shall not exceed 3 percent.

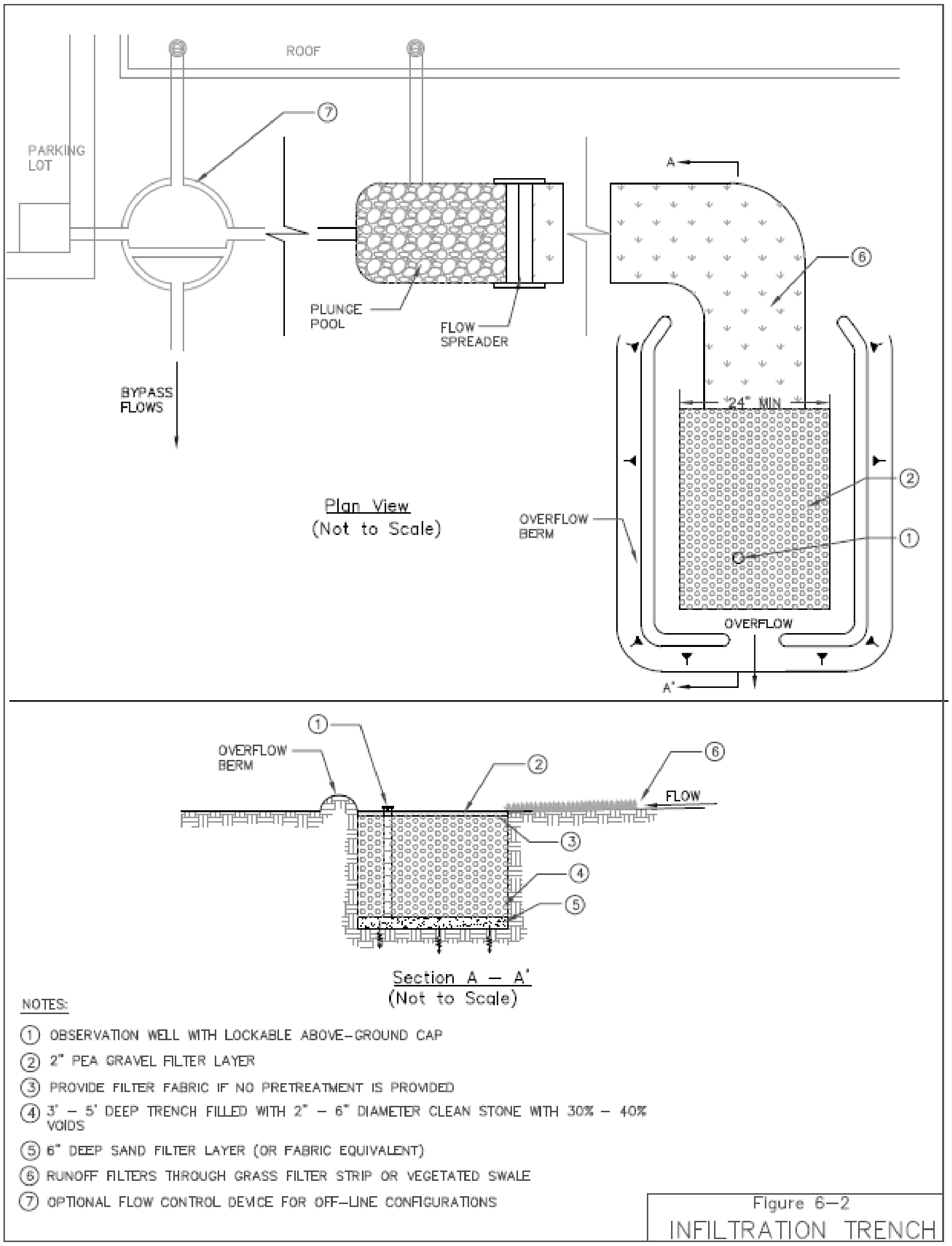
FIGURE 4 illustrates the plan and section view provided by the handbook.

The CASQA BMP Handbook (2003) defines an infiltration trench as “a long, narrow, rock-filled trench with no outlet that receives stormwater runoff”. Additionally, pretreatment in the form of buffer strips, swales, or detention basins are often preferred to limit the amount of coarse sediment entering the system. The CASQA BMP Handbook (2003) also states that infiltration trenches are an efficient BMP for removing fine sediments and related pollutants. TABLE 4 summarizes the advantages and disadvantages of infiltration trenches according to the 2003 CASQA BMP Handbook.

TABLE 4. Advantages and Disadvantages Based on the CASQA BMP Handbook (2003)

Advantages	Disadvantages
➢ Provides 100 percent reduction in the surface runoff captured ➢ Provides control of channel forming (erosion) and high frequency flood events if sized correctly ➢ Unobtrusive and has little impact on site aesthetics since it is underground	➢ High failure rate with poor subsurface soils ➢ Limited use for large drainage areas (greater than five acres) ➢ Limited use on fill sites or steep slopes ➢ Difficult to restore functions once clogged

The CASQA BMP Handbook (2003) identifies various limitations that must be taken into account when designing an infiltration trench using their methodology. The notable design criteria are summarized as follows: tributary drainage area should not exceed five acres; minimum soil infiltration rate of 0.5 inches per hour is required; sites



NOTES:

① OBSERVATION WELL WITH LOCKABLE ABOVE-GROUND CAP
② 2" PEA GRAVEL FILTER LAYER
③ PROVIDE FILTER FABRIC IF NO PRETREATMENT IS PROVIDED
④ 3' – 5' DEEP TRENCH FILLED WITH 2" – 6" DIAMETER CLEAN STONE WITH 30% – 40% VOIDS
⑤ 6" DEEP SAND FILTER LAYER (OR FABRIC EQUIVALENT)
⑥ RUNOFF FILTERS THROUGH GRASS FILTER STRIP OR VEGETATED SWALE
⑦ OPTIONAL FLOW CONTROL DEVICE FOR OFF-LINE CONFIGURATIONS

FIGURE 4. Infiltration trench plan and section view from the LACDPW BMP Design and Maintenance Manual (2009).

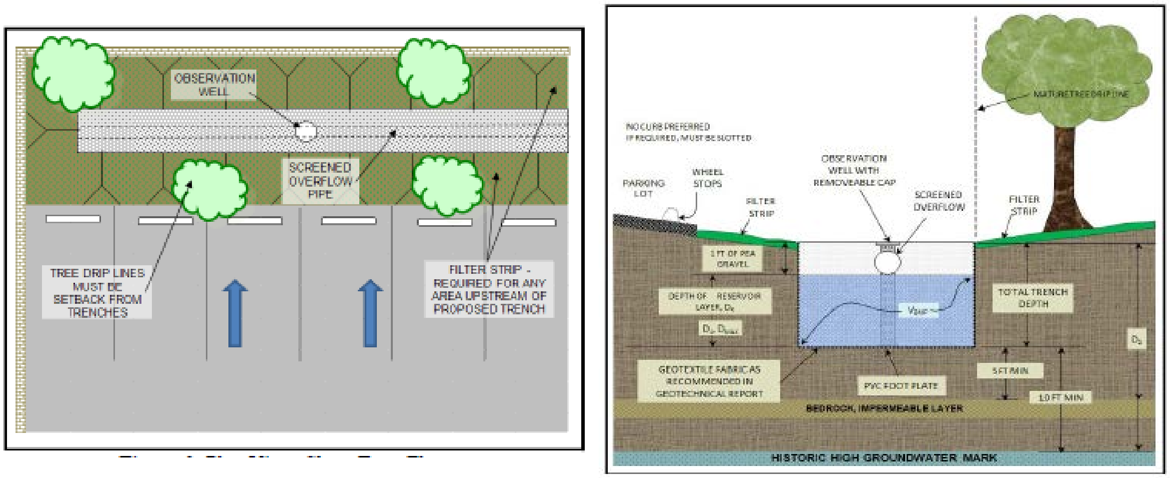
underlain by hydrologic soil types C and D should not implement infiltration trenches; pretreatment is required if infiltration rates exceed 2.4 inches per hour to protect groundwater quality; not suitable on fill sites or steep slopes; upstream drainage area must be fully stabilized before construction; subsurface soil should not have more than 30 percent clay or 40 percent clay and silt combined; groundwater separation should be at least three meters (about 10 feet) from the trench invert to the measured groundwater elevation; trench site should be greater than six meters (about 20 feet) away from buildings, slopes, and highway pavements, and greater than 30 meters (about 98 feet) away from wells and bridge structures; and sites constructed with fill or having a slope greater than 15 percent should not be considered.

The Riverside County Flood Control and Water Conservation District BMP Handbook (2011) defines an infiltration trench as “an excavated trench that has been refilled with a gravel and sand bed capable of holding the design volume of stormwater runoff”. The handbook goes on to explain that the captured runoff is stored for an extended period of time allowing it to infiltrate back into the naturally pervious surrounding soil. It is recommended that an upstream control is implemented, such as a grass swale or filter strip, in order to remove sediments that might clog the trench. In addition, the system should include a bypass and an observation well. The 2011 Riverside County Flood Control and Water Conservation District BMP Handbook focuses mostly on design methodology and criteria and does not focus on the advantages and disadvantages. The advantage and disadvantage identified based on the material presented in the handbook are summarized in TABLE 5.

TABLE 5. Advantages and Disadvantages Based on the Riverside County Flood Control and Water Conservation District BMP Handbook (2011)

Advantages	Disadvantages
➢ Removes soluble and particulate pollutants	➢ Does not address coarse sediments

The Riverside County Flood Control and Water Conservation District BMP Handbook (2011) identifies various limitations that must be taken into account when designing an infiltration trench using their methodology. The handbook references Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures, the City of Modesto's Guidance Manual for New Development Stormwater Quality Control Measures, the California Stormwater BMP Handbook for New Development and Significant Redevelopment, and the Riverside County Drainage Area Management Plan as the sources of the design criteria. The notable design criteria are summarized as follows: maximum drawdown time of 48 hours; maximum tributary area of ten acres; minimum infiltration rate of 0.27 inches per hour; trench invert elevation must be five feet or more above seasonally high groundwater table; maximum trench depth (D_m) should be eight feet; gravel bed should be composed of clean, washed aggregate one to three inches in diameter; trench should be lined with geotextile fabric or a six-inch layer of sand; minimum setbacks should be 100 feet from wells, tanks, fields, or springs and 20 feet down slope or 100 feet up slope from foundations; and trench should not be sited under tree drip-lines. FIGURE 5 illustrates the plan and section view provided in the handbook.



Plan View

Section View

FIGURE 5. Infiltration trench plan and section view from the Riverside County Flood Control and Water Conservation District BMP Handbook (2011).

3.3.1 Infiltration Trench Summary

As previously discussed the design of the system in the laboratory and at the Manor was based on the design of an infiltration trench. There are various similarities and differences between infiltration trench designs according to the manuals reviewed. TABLE 6 summaries the key similarities and differences.

The main components in the table that influenced the design of the system in the laboratory and at the site include the infiltration rate, clay content of surrounding soils, and the system depth. The infiltration rate and clay content provide key information regarding the soil characteristics needed for flows to be able to move through the system. At the site, the goal was not to infiltrate into the soils, but rather to convey excess flows to the pipe system. Even though the goals are different, the infiltration rate and soil characteristics help determine the types of media that would allow the system to function properly. The system depth used at the site was approximately three feet, which is consistent with the manuals that specified depths. The lower end of the system depth was used for the site because additional depth was not required for storage as it is in an infiltration trench.

Other characteristics discussed in the table would have played a more major role if they were applicable to the site conditions at the site. The area designated on site for the system was at least 25 feet away from a building as suggested by most of the BMP manuals, otherwise this design parameter would have been more important. Having a subsurface water storage system close to a building foundation may cause damage to the building, thus it should be offset. The minimum distance from a drinking water well was not applicable at the site, thus this characteristic did not influence the design of the system. The system would not have been constructed if there was a drinking water well within 100 feet, as this could potentially contaminate drinking water supply. Also the separation between the invert of the infiltration system and the groundwater table was also not an issue at the Manor, as historically, groundwater was not encountered near the surface at the site. This would have played a more major role if there was a shallower groundwater table and if the system was designed to infiltrate, as this could create problems related to groundwater mounding.

TABLE 6. Infiltration Trench Parameter Design Summary

Parameter	LAC SUSMP	LACDPW BMP Design Manual	CASQA BMP Handbook	Riverside County BMP Handbook
DA	≤ 2 acres	-	≤ 5 acres	≤ 10 acres
DA Slope	≤ 20%	≤ 25%	≤ 15%	-
Infiltration (in/hr)	≥ 0.3	≥ 0.5	≥ 0.5	≥ 0.27
Clay Content	≤ 30%	-	≤ 30-40%	-
Minimum GW Separation	4 feet	-	10 feet	5 feet
Distance from Drinking Well	100 feet	100 feet	100 feet	100 feet
Distance from Building	100 feet	8 feet	20 feet	20 feet
System Depth	3-8 feet	3-5 feet	-	≤ 8 feet
Drawdown	-	≤ 72 hours	-	≤ 48 hours

Notes:

DA = Drainage Area, GW = Groundwater, - = not specified in document.

CHAPTER 4

INITIAL PROTOTYPES

A preliminary phase of the study that led to the development of the field system was conducted in collaboration with a team of students at CSULB. This development phase included four major steps: 1) testing of soil; 2) development of design concepts; 3) testing on small scale physical models; and 4) building and testing a laboratory scale model. Each of the models utilized soil from the Manor, for which hydraulic conductivity tests were conducted in the laboratory. Each of the small-scale models underwent testing to help better understand how the system would operate in the field. This chapter reports the progression of the design process and laboratory testing conducted.

4.1 Hydraulic Conductivity

Hydraulic conductivity is a physical property of soil and is dependent on the porosity, particle size and distribution, shape of the particles, and other factors, as well as properties of the fluid (Todd 2005). Fine soils have low hydraulic conductivity, as it is difficult for water to travel through the particles while coarser soils have high hydraulic conductivity as there is a large volume of void space due to the particle shapes and sizes. The structure of the soils also plays a role. Hydraulic conductivity in the saturated zone can be determined in the laboratory using a permeameter, where the flow is maintained through a sample and the flow rate and head loss are measured (Todd 2005).

The soil from the site was collected and tested to determine the average hydraulic conductivity. Samples were collected in the field in a manner that sample disturbance was minimized. The top few inches of soil was disturbed and then the layers below were carefully collected by hand. The soil was tested in the laboratory using both the falling head and constant head permeability tests.

4.1.1 Falling Head Permeability Test

Falling head permeability tests were conducted in the laboratory to determine the hydraulic conductivity of the soil at the site. In a falling head permeability test, water is forced by falling head pressure through a soil sample of known dimensions to determine the flow rate through the media. This method is preferred for soils with relatively fine grain sizes, which often have a lower hydraulic conductivity. The test is conducted using an apparatus which includes an elevated reservoir and soft pipe that is connected to the soil sample. The soil sample is fully saturated prior to running the test. The reservoir is filled to an initial level and the water level decreases throughout the duration of the test (Department of Transportation 1998). The water flows upward through the cylindrical sample and is collected as overflow as shown in FIGURE 6.

The hydraulic conductivity of the soil can be obtained by noting that the flow rate in the tube (Equation 1) must equal the flow rate through the sample (Equation 2). After equating and integrating the hydraulic conductivity can be determined (Equation 3) (Todd 2005).

$$Q_{tube} = \pi {r_t}^2 \frac{dh}{dt} \tag{1}$$

$$Q_{media} = \pi {r_c}^2 K \frac{h}{L} \tag{2}$$

$$K = \frac{{r_t}^2 L}{{r_c}^2 t} \ln\left(\frac{h_1}{h_2}\right) \tag{3}$$

Where:

Q_{tube} = flow rate through the tube as volume per time

r_t = radius of the tube

dh/dt = change of the hydraulic head $(h_2 - h_1)/(t_2 - t_1)$

Q_{media} = flow rate through the soil media as volume per time

r_c = radius of the soil sample

K = hydraulic conductivity in length per time

t = time interval for the water level in the tube to fall from h_1 to h_2

L = length of the soil sample

Three falling head permeability tests were conducted using the soil from the site and the methods described above. The testing data and results are reported in TABLE 7. For all experiments the height of the sample was 2.36 inches, the diameter of was 2.11 inches, the cross sectional area was 3.49 square inches, and the area of the tank was 67.17 square inches. The results found using the falling head permeability test were not consistent. The inconsistency found in the laboratory testing may be due varied sample compaction. The inconsistency could also be due to a problem with the equipment setup, which could include the initial saturation of the sample.

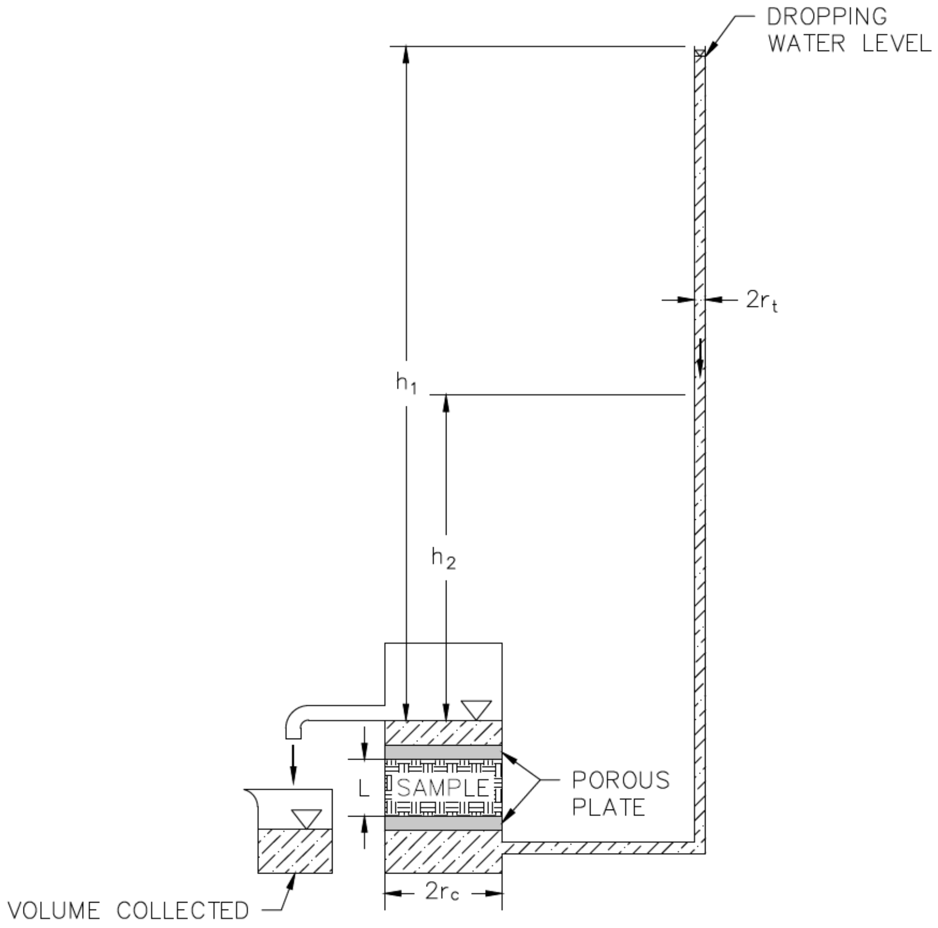


FIGURE 6. Falling head permeability test configuration.

TABLE 7. Falling Head Permeability Test Results for Hydraulic Conductivity

Test Parameters	Test 1	Test 2	Test 3
Date:	11/21/13	11/22/13	11/22/13
Initial Height in Reservoir (in):	28.25	28.25	28.13
Final Height in Reservoir (in):	28.20	28.06	28.00
Test Time (min):	45	60	73
Hydraulic Conductivity (in/min):	0.002	0.005	0.003
Hydraulic Conductivity (ft/day):	0.198	0.604	0.332
Average (ft/day):		0.378	

4.1.2 Constant Head Permeability Test

In a constant head permeability test, water is forced by a constant and known pressure through a soil sample of known dimensions to determine the flow rate. This test is the preferred method for soils that contain mostly sand or gravel, media that is expected to have a higher permeability and hydraulic conductivity. The test is conducted using an apparatus which includes an elevated reservoir and soft pipe that is connected to the soil sample, a similar setup as the falling head permeability test. During the duration of the test, the water level in the reservoir is kept constant (Department of Transportation 1998). During this test, the water flows upward through the cylindrical sample and is collected as overflow as shown in FIGURE 7.

The hydraulic conductivity of the soil using the constant head permeability test can be found using the following equation (Todd, 2005):

$$K = \frac{VL}{Ath} \qquad (4)$$

Where:

K = hydraulic conductivity in length per time

V = flow volume in time (t)

A = horizontal area of sample

h = distance from the surface of the reservoir to the surface of the sample

Seven constant head permeability tests were conducted using the soil from the Manor and the methods described above. It was clear that the soils had high clay content; however, the constant head permeability test was conducted for confirmation purposes. TABLE 8 summarizes the testing data and results. The height of all the soil samples was

2.36 inches, the diameter was 2.11 inches, the cross sectional area was 3.49 square inches, and the area of the tank was 67.17 square inches.

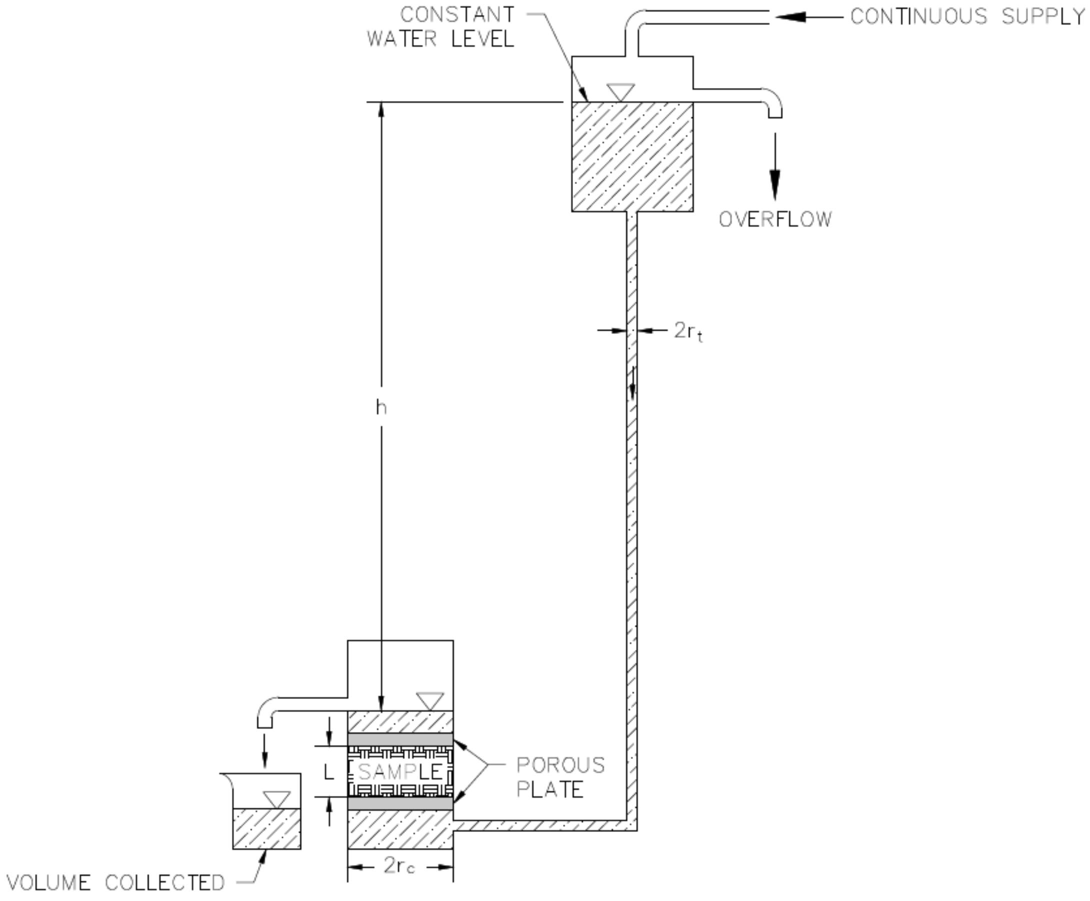


FIGURE 7. Constant head permeability test configuration.

TABLE 8. Constant Head Permeability Test Results for Hydraulic Conductivity

Test Parameters	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7
Head (in):	41.75	37.38	33.00	32.63	32.38	32.38	32.38
Test Time (min):	48	49	80	37	32	33	33
Volume collected (mL):	492	492	464	268	273	293	280
Hydraulic Conductivity (in/min):	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002
Hydraulic Conductivity (ft/day):	1.21	1.33	0.87	1.11	1.30	1.33	1.29
Average (ft/day):				1.20			

4.1.3 Permeability Test Conclusions

Typically, the permeability test performed (falling head or constant head) is dependent on the type of soil at the site (clay versus sand). The soil at the Manor is clayey, therefore the falling head permeability tests would be recommended for determining the hydraulic conductivity. The results summarized in Section 4.1.1 pertaining to the falling head permeability test represent a more accurate quantification of soil characteristics at the Manor. An average hydraulic conductivity of 0.378 feet per day was considered as representative of the soil at the site..

4.2 Potential Design Models

The first step to establishing the system design involved developing potential designs and testing small-scale physical models to evaluate the water collection and conveyance within the system. Three physical models were built and tested in small plastic storage containers.

4.2.1 Model #1

The first potential design model is illustrated in FIGURE 8. This design used geotextile (GSE NW6) and a composite geosynthetic (GSE Fabrinet - geotextile plus geonet), as illustrated in FIGURE 9. The geotextile is a fabric like material that provides filtration and layer separation. The composite geosynthetic is comprised of the geotextile with a geogrid, a plastic screen like material, which allows for additional void space, often used to facilitate drainage.

The collection pipe was placed down the center of the plastic container and the geocomposite was sloped towards the pipe. A geotextile was used on top of the geocomposite in order to provide layer separation between the top layer of soil and the drainage path provided by the geogrid. Soil from the site was used on top of the collection system.

To test the system, 4,000 milliliters of water was added to the surface and the volume of water collected through the outlet pipe over a time interval of one hour was measured. The system collected 7.5 percent of the water added. The uncollected water was ponded on top of the system, absorbed by the materials, and found on the sides of the collection pipe.

4.2.2 Model #2

The second collection system potential design model is illustrated in FIGURE 10. The collection pipe was placed down the side of the plastic container and the geogrid and plastic corrugated sheet system was sloped towards the pipe. A geotextile was used on top of the geogrid to provide layer separation between the top layer of soil and the

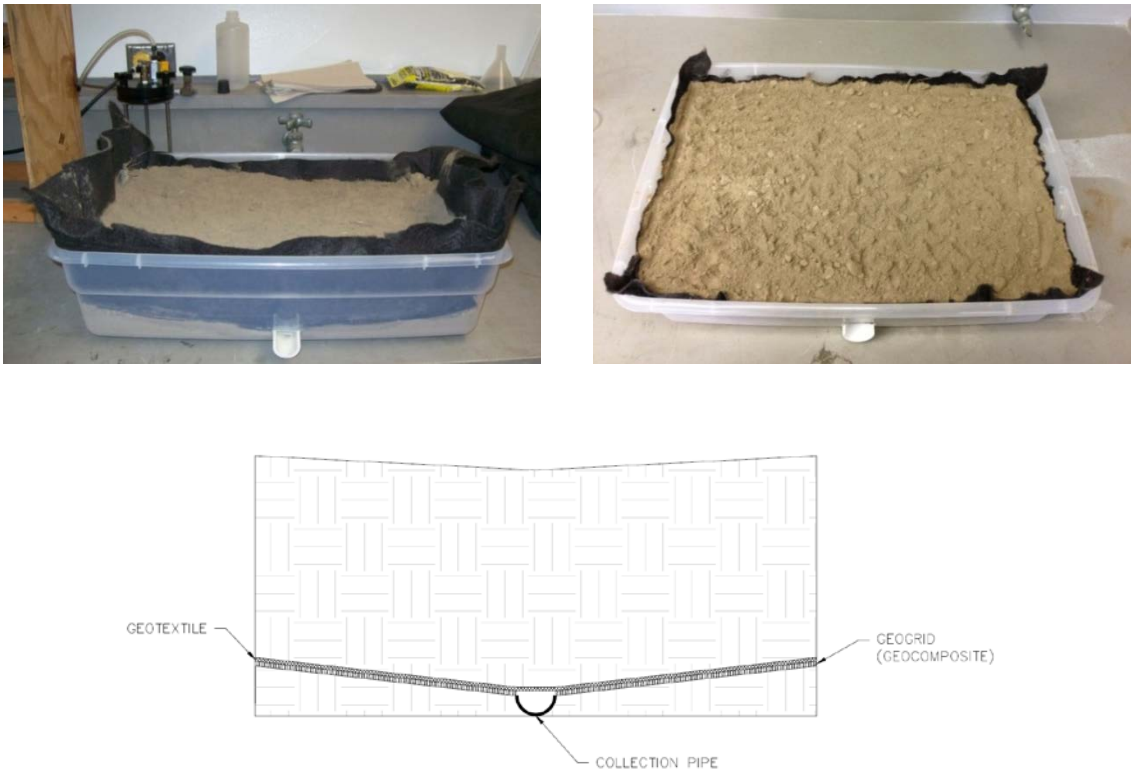


FIGURE 8. Model #1 schematic.

FIGURE 9. Model #1 materials.

drainage path provided by the geogrid and corrugated plastic sheet. Soil from the site was used on top of the collection system. This system was constructed and tested for comparison purposes. It is unlikely that this type of system would be built on a larger scale or at the site.

This design used geotextile (GSE NW6), geogrid (GSE Hypernet), and corrugated plastic sheet, illustrated in FIGURE 11. The geotextile was used to provide filtration and layer separation and the geogrid was used to provide additional void space to facilitate drainage. A piece of corrugated plastic sheet was used to further increase the void space and facilitate drainage.

To test the system, 4,000 milliliters of water was added to the surface and the volume of water collected through the outlet pipe over a time interval of one hour was measured. The system collected approximately 5 milliliters, demonstrating that the system did not function properly due to clogging. The uncollected water was ponded on top of the system, absorbed by the materials, and found on the sides of the collection pipe underneath the corrugated plastic sheet.

4.2.3 Model #3

The third potential design model is illustrated in FIGURE 12. This design used geotextile (GSE NW6) and gravel. The geotextile was used to provide filtration and layer separation and the gravel was used to create trenches that would provide additional void space and facilitate drainage. The gravel was placed in trenches that were directed towards three collection pipes.

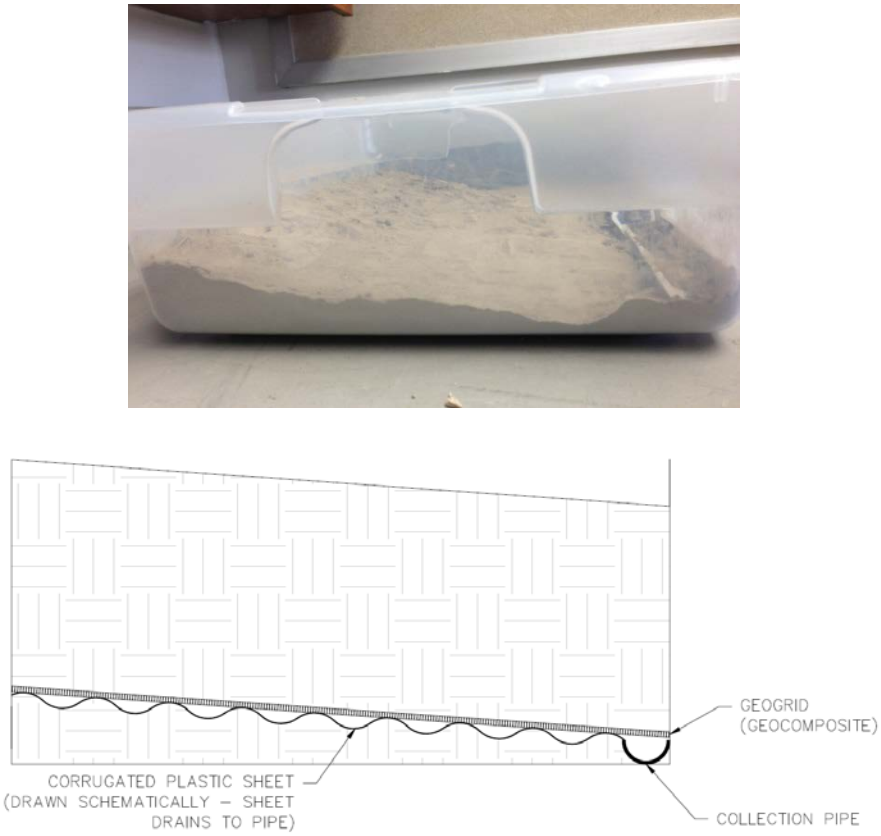


FIGURE 10. Model #2 schematic.

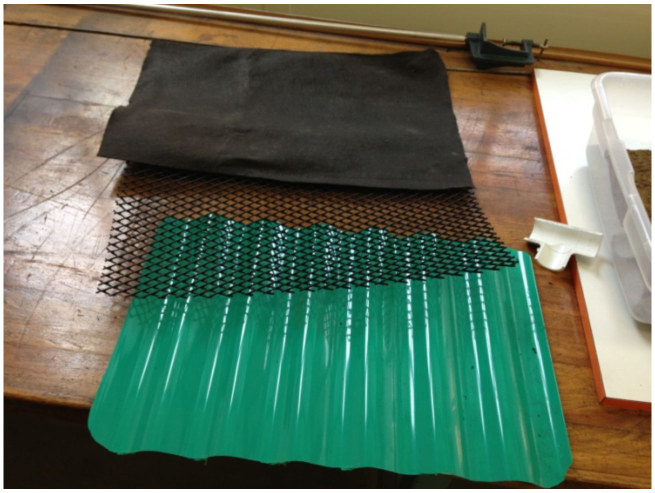


FIGURE 11. Model #2 materials.

The collection pipes were placed on both sides and in the center of the plastic container. The surface was sloped towards the gravel trenches and the gravel trenches sloped towards the pipes. A geotextile was used to ensure the fines in the soil would not clog the voids provided by the gravel. Soil from the site was used on top of the collection system.

To test the system, 4,000 milliliters of water was added to the surface and the volume of water collected through the outlet pipe over a time interval of one hour was measured. The system collected more than 10 percent of the water added. The uncollected water was ponded on top of the system, absorbed by the materials, and found on the sides of the collection pipes.

In summary, the third model concept performed the best and is most feasibly implemented at a larger scale. TABLE 9 summarizes the advantages and disadvantages identified during the model concept development and testing.

4.3 Laboratory Prototype

The small-scale potential design models provided enough insight to help develop a design for a larger-scale laboratory prototype, which was built in the CSULB laboratory in a 6-foot by 6-foot plastic tank for testing. The gravel trench small-scale model design was comparable to an infiltration trench and the review of various BMP manuals and handbooks provided guidelines for the design. The design was modified for this larger system to maximize capture efficiency. The knowledge gained through the literature review along with laboratory experience served as the basis for the design of the laboratory prototype.

FIGURE 12. Model #3 schematic.

TABLE 9. Advantages and Disadvantages of Design Concept Models

Model	Advantages	Disadvantages
1	➢ Design facilitates drainage	➢ Requires excavation of entire site
2	➢ Large void spaces provided	➢ Requires excavation of entire site ➢ Plastic sheet not recommended ➢ Little flow collected
3	➢ Design facilitates drainage ➢ Materials are inexpensive	➢ Requires excavation of entire site

4.3.1 Design

The gravel trench collection system is similar to the infiltration trench BMP discussed as part of the literature review. The main differences are that an infiltration trench BMP is designed to capture water produced by rain events rather than irrigation and is designed to infiltrate flows rather than collect them.

The small-scale gravel trench collection model (Model #3) performed the best during the initial model testing, but the configuration was slightly modified to more closely mimic an infiltration trench to improve the collection. The third potential design placed pipes between the trenches rather than directly within them making it so the water had to travel downward and then laterally to reach the collection pipe.. The potential design model was designed to infiltrate flows in the trenches and then convey flows laterally to the collection pipes through the gravel layer (blanket) that extended along the bottom of the system (see FIGURE 12). The design for the laboratory prototype uses the gravel trenches from the third potential design model, but places the pipes within the trench at the bottom of the system so that flows do not have to travel laterally. By doing this, the cost is minimized as the whole area does not need to be excavated to construct the bottom gravel "blanket", requiring that only the trench area is excavated. Additionally, the gravel trenches were wrapped in geotextile fabric so that the voids supplied by the gravel would not be filled over time as the fine particles start to settle. These design features are consistent with some of the design guidelines for infiltration trench BMPs.

Similar to the small-scale models, the soil on the surface of the system would be sloped towards the trenches to direct flows to the points of collection. Two pipes were used and were connected downstream of the gravel trenches so that there was only one outlet point.

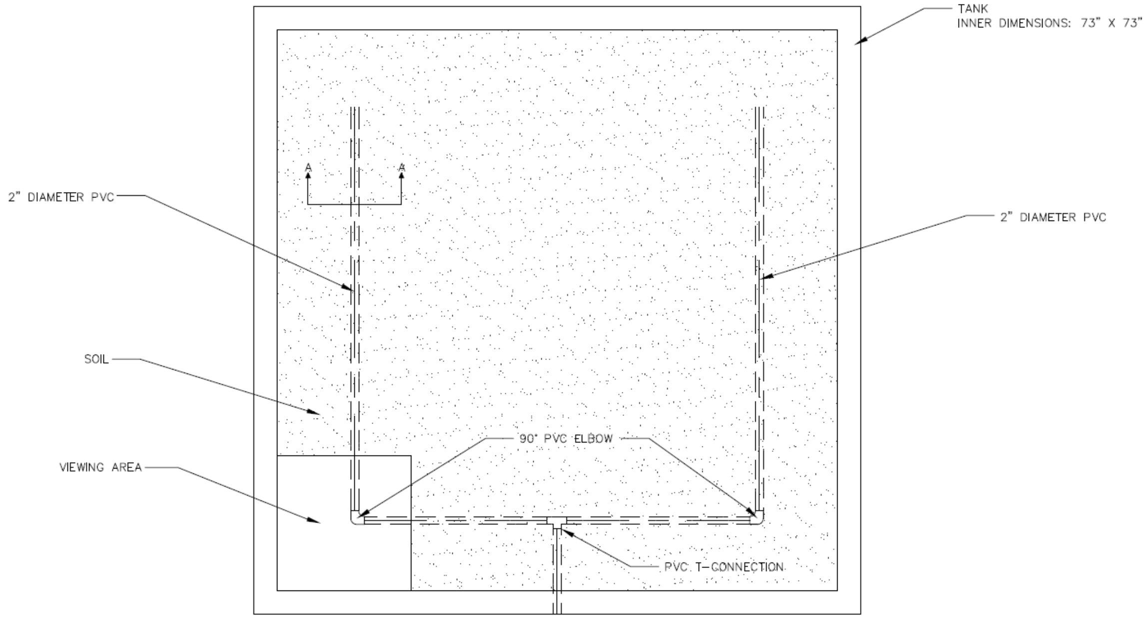
The laboratory prototype design also included a layer of sod. The sod was included so that the model would mimic the conditions at the Manor. The vision associated with the project is a system that is buried beneath typical grassy areas that is able to collect and reuse irrigation water in an effort to conserve. To better visualize the system, a viewing window was incorporated into the design, leaving one corner open so that flows could be observed in the collection pipe. FIGURE 13 shows the plan and profile view of the laboratory prototype design.

4.3.2 Construction

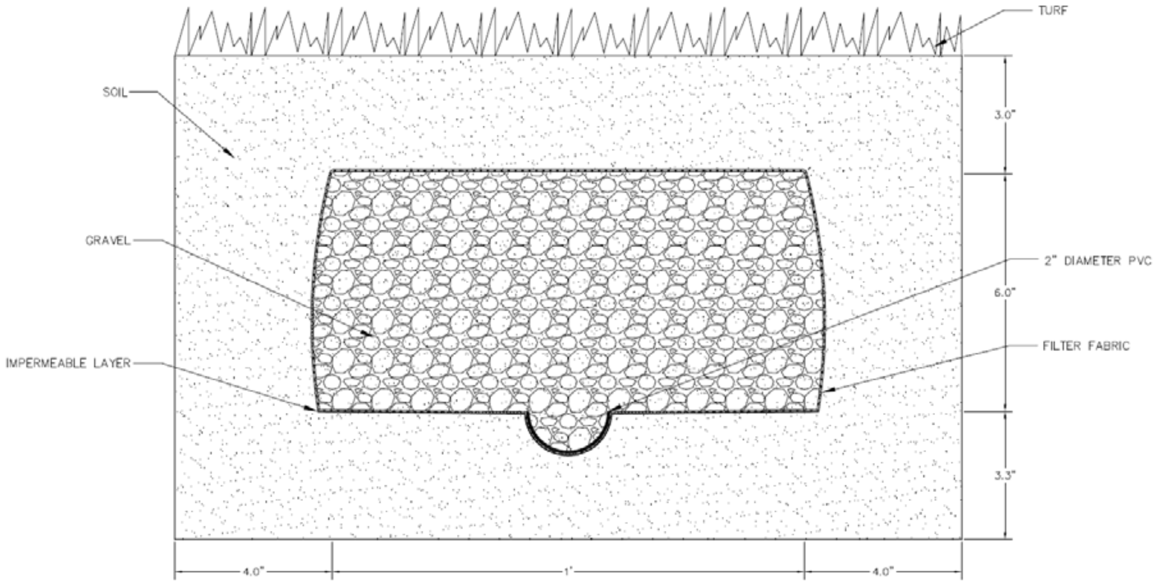
Similar to the potential design model, the major materials required for the construction of the laboratory model were: soil from the Manor; geosynthetics; Polyvinyl Chloride (PVC) pipes and junctions; gravel; sand; and sod.

The soil was retrieved from the site by hand excavation and transported to the CSULB laboratory. The remaining materials were obtained at local hardware stores and through local material distributors.

Prior to implementing the prototype design, the contents of the tank had to be removed. Trenches were constructed with a wood form so that the gravel could be poured up to the design depth and the soil could be filled in on the sides. This allowed the trench to maintain the desired vertical shape and eased the construction process.



(a) Plan View



(b) Profile View

FIGURE 13. Laboratory prototype plan and profile.

Additionally, this method allowed the construction to take place over time rather than in one day. In addition, the tank had to be cut to allow the pipe system to discharge for flow measurements.

The geosynthetics, pipes, trenches, and sod were installed per the design plans provided in Appendix A and shown in FIGURE 13.

4.3.3 Testing

Testing of the laboratory prototype was the next step to demonstrate the design would work at the Manor. Just like the potential design models, a specific amount of water was added to the prototype, and was then collected over a specified time interval. After several tests, the average efficiency of the system was determined to be around 83 percent. TABLE 10 summarizes the data collected during the capture efficiency testing.

TABLE 10. Summary of Capture Efficiency for the Laboratory Prototype

Test No.	Volume Applied (gallons)	Time Until First Drop (minutes)	Collection Time (minutes)	Volume Collected (gallons)	Capture Efficiency
1	22.5	2.96	60	18.77	83%
2	10.4	2.66	60	9.82	95%
3	15.1	2.44	61.45	10.58	70%

The capture efficiencies documented during lab experiments are extremely high due to the system being closed. There is very little opportunities for losses from the system. The results in the field are expected to be a lot lower than those in the laboratory due to the increased opportunities for losses. In the field, losses occur through lateral seepage and infiltration.

As described in Section 4.1, permeability tests were performed with the soil from the Manor to determine the hydraulic conductivity. After several tests, the average hydraulic conductivity was determined to be 0.378 feet per day based on the falling head permeability test, which is more applicable for clayey soils (Section 4.1.1). Based on the infiltration BMP manuals reviewed, this infiltration rate would not be recommended for soils above an infiltration trench. Since the soil does not have a very high hydraulic conductivity, the success of the subsurface drainage system was largely due to the gravel trenches above the collection pipes. The high permeability of the gravel, due to large void spaces, allowed the system to collect a significant portion of the water added.

One design challenge was faced during the construction and testing of the laboratory prototype. The obstacles was resolved and contributed to a better understanding of the fundamental mechanisms. While the laboratory prototype did allow for more applicable test results compared to the potential design models, the size of the system was smaller than the space available in the field and therefore posed some challenges during construction. The limited space constricted the design by limiting the slopes of pipes and the PVC connections that could be used. The design sited a collection pipe on the right and left side of the tank with an outlet in the center. The design incorporated the use of a tee connection and during construction it became apparent that the tee connection did not allow for a steep slope, only as much as the connection could bend. With enough manipulation, an adequate slope was provided for the pipe. Future designs would drain to one side or utilize two wye connections to that adequate slope can be provided.

CHAPTER 5

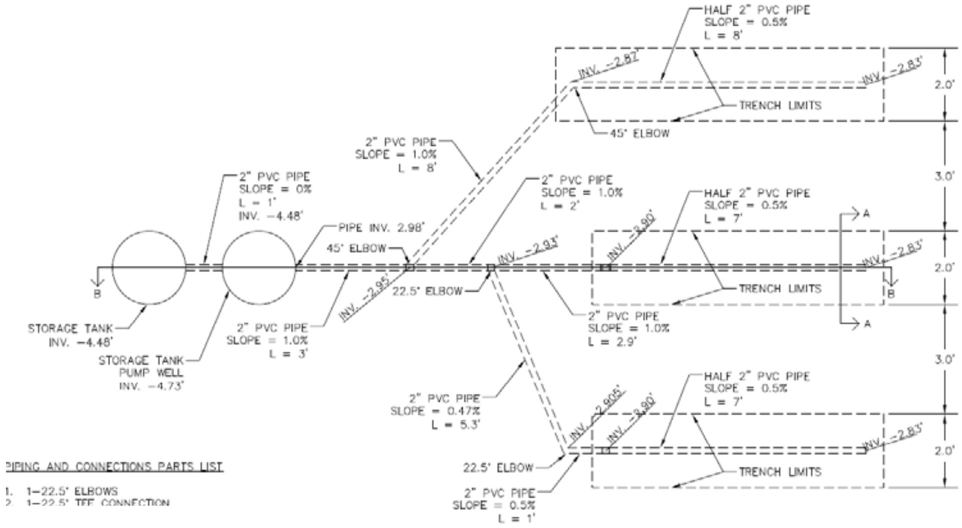
SITE DESIGN

5.1 Design

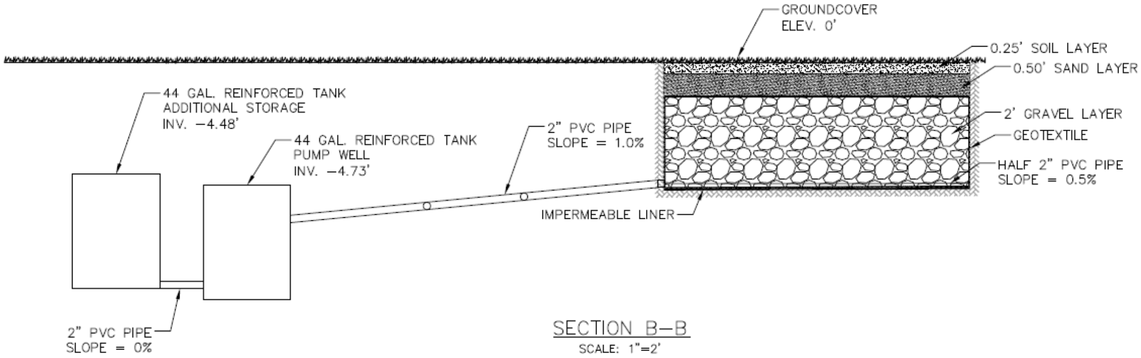
The site design was based on the previous experiments involving the potential design models and laboratory prototype. Experience gained in a professional work setting also greatly influenced the design. The design for the laboratory prototype had to be modified due to the size of the project area and also the pipe configuration was modified based on the challenges faced during the laboratory prototype construction. FIGURE 14 illustrates the plan view of the design for the Manor. The complete design plans are provided in Appendix B.

The main differences between the laboratory prototype and the system designed for the Manor was the size, utilization of a third pipe and trench, use of a sand layer, and integration of a holding tank. As expected, the size of the trenches and pipes were increased for the Manor as compared to the laboratory prototype. A third pipe was used because the area in the field was larger and it would help increase capture efficiency. During the development of the laboratory prototype, it was noted that the placement of pipe joints must be strategic. Two wye joints were used to connect the two outside pipes to the center pipe, with a minimum of one foot of separation between the connections.

The system designed for the Manor incorporated a sand layer within the collection trench design to minimize the amount of soil that would be required above the trench. The soil has high clay content which decreases the rate at which water percolates, therefore the sand would replace the soil and provide additional filtration. No other major modifications were made to the trench design compared to the laboratory prototype.



(a) Plan View



(b) Profile View

FIGURE 14. Manor system plan and profile.

A holding tank was incorporated into the collection system at the Manor so that the collected water could be stored and then eventually pumped to an existing or proposed irrigation system. The connection to the irrigation system was not included in this study. The holding tank area facilitated data collection during the design process to determine the capture efficiency of the system and the change in the capture efficiency with the addition of different media layers. Testing was conducted and water was collected by keeping the outlet open and postponing installation of the tank and pump.

As mentioned in Section 2.2, an average of 10,151,856 gallons per year was used for irrigation at the Manor between 2006 and 2010. Staff at the Manor reported reducing their irrigation due to current initiatives to save water therefore the Environmental Protection Agency (EPA) Interactive Water Budget Tool (2015) for estimating irrigation need was used to identify a volume of water recommended for the study area which is approximately 25 feet by 25 feet (625 square feet). To use the water budget tool, the location of the Manor was specified by the zip code and the area to be irrigated, plant type, water demand, and irrigation type were specified. The input and output parameters are shown in TABLE 11. It was then assumed that there are approximately 4.5 weeks in a month and irrigation events occurred four times per week. Based on these assumptions, each irrigation event over the study area would require approximately 39.5 gallons. This volume was then used to size the trenches. If the volume reported by the Manor (10,151,856 gallons per year) was used and it was assumed that approximately 3.5 acres required irrigation based on an analysis of aerial imagery then over 100 gallons would be required per irrigation event over the study area. The volume from the EPA water budget tool is more realistic and was used for the design.

TABLE 11. EPA Water Budget Tool Irrigation Input and Output (2015)

Input				Output
Area (square feet)	Plant Type	Water Demand	Irrigation Type	Required Water (gal/month)
625	Groundcover	Low	Micro Spray	711

The trench system was originally designed to maximize capacity so that it could capture each irrigation event and also capitalize on rainfall. Based on the design plans shown in FIGURE 14 and provided in Appendix B, the trenches have a capacity of 85 gallons each, assuming the void ratio of the sand is 0.15 and the void ratio of the gravel is 0.35. These void ratios are typical values based on the LACDPW BMP Design and Maintenance Manual (2009).

5.2 Construction

The construction of the prototype at the Manor was an extended process due to the testing that was conducted intermittently. The construction process entailed obtaining materials and manual labor.

The materials required for the collection system at the Manor were similar to those required for the laboratory prototype, and included PVC pipes and joints, geosynthetics, gravel, sand, and sod. The pipe materials were obtained at a local hardware store. Geotextile was obtained from GeoSynthetics and was specified as Mirafi 140N. Sand and gravel were purchased from local construction material suppliers. Fesque sod was obtained from a local nursery (H&H Nursery).

The maintenance staff at the Manor excavated the site based on the design plans. The task turned out to be labor intensive and required heavy equipment due to the clayey soil at the site.

To check that the system would work as intended, it was tested throughout construction in the same manner as the laboratory prototype. The pipe within each trench was laid and then water was added to check if a sufficient slope was provided. The pipes in each of the trenches were reinstalled multiple times until the water flowed freely with the given slope. The gravel was slowly added to the trench and the pipe was tested to make sure no blockages occurred within the system. Each of the trenches was originally layered as specified in the plans, outlined in FIGURE 14 and provided in Appendix B, however, the system design had to be slightly modified. The reason for modifying the system is further discussed in the following section and pertains to the pipe configuration and layered media composition. FIGURE 15 illustrates the as built profile view of the system constructed at the Manor and detailed drawings are provided in Appendix B. Based on the revised design, the trenches have a capacity of 97.2 gallons each, assuming the void ratio of the sand is 0.15 and the void ratio of the gravel is 0.35.

5.3 Testing

The system at the Manor was tested at various stages to make sure it was working and check if it was efficient. These tests were conducted0 so that modifications to the system could be made as it was built. The same testing methodology used for the laboratory prototype was followed for the Manor. A known volume of water was applied to the system and the volume collected over a given time at the outlet pipe was recorded. In addition to testing the complete system, volumetric measurement tests were conducted as different media layers were added to the system to help quantify the changes in capture efficiency due to the different layers. This section discusses the testing and results for the gravel layer only, the sand and gravel layers, and the entire system.

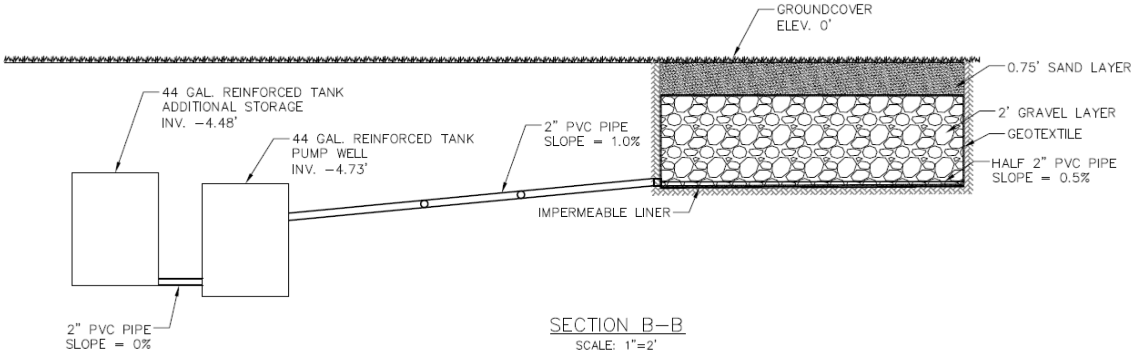


FIGURE 15. As built Manor system profile.

5.3.1 Gravel Layer Only

Once the gravel layer was added to the system, three tests were conducted to determine the capture efficiency. The test results are summarized in TABLE 12 and FIGURE 16, while more detailed test logs can be found in Appendix C. Thirty gallons of water was applied evenly between the three trenches during each test using a flow meter connected to the supply hose. Thirty gallons of simulated irrigation is close to the EPA water budget tool (2015) projection of 39.5 gallons being needed per irrigation event over the study area. It was also determined during initial testing that this volume would over saturate the system and produces a measurable output.

TABLE 12. Summary of Capture Efficiency for Gravel Layer Only

Test No.	Volume Applied (gallons)	Volume Collected (gallons)[1]	Efficiency	Days Since Last Test
1	30	5.33	18%	-
2	30	11.11	37%	4
3	30	17.86	60%	7
	Average:	34.30	38%	-

[1] Volume collected one hour after application.

As would be expected, the capture efficiency of only the gravel layer was high due to the large void spaces and shallower media depths. The efficiency of the system increased during each additional test. Ordinarily, tests would have been performed until the data creates an obvious trend, but all of the testing had to be completed prior to the rainy season so only three tests were performed. The days between tests were documented to help determine if any trends exist. One possible explanation for increasing efficiency over time is that the system remained partially saturated from the previous test. The first test demonstrated a low return while subsequent tests collected more water as the water applied pushed the remaining water in the system from the previous test out. Results from tests described below will not necessarily agree with this theory, as a consistent upward trend in capture efficiency was not found. It is expected that over time the system would normalize and the trend would flatten out.

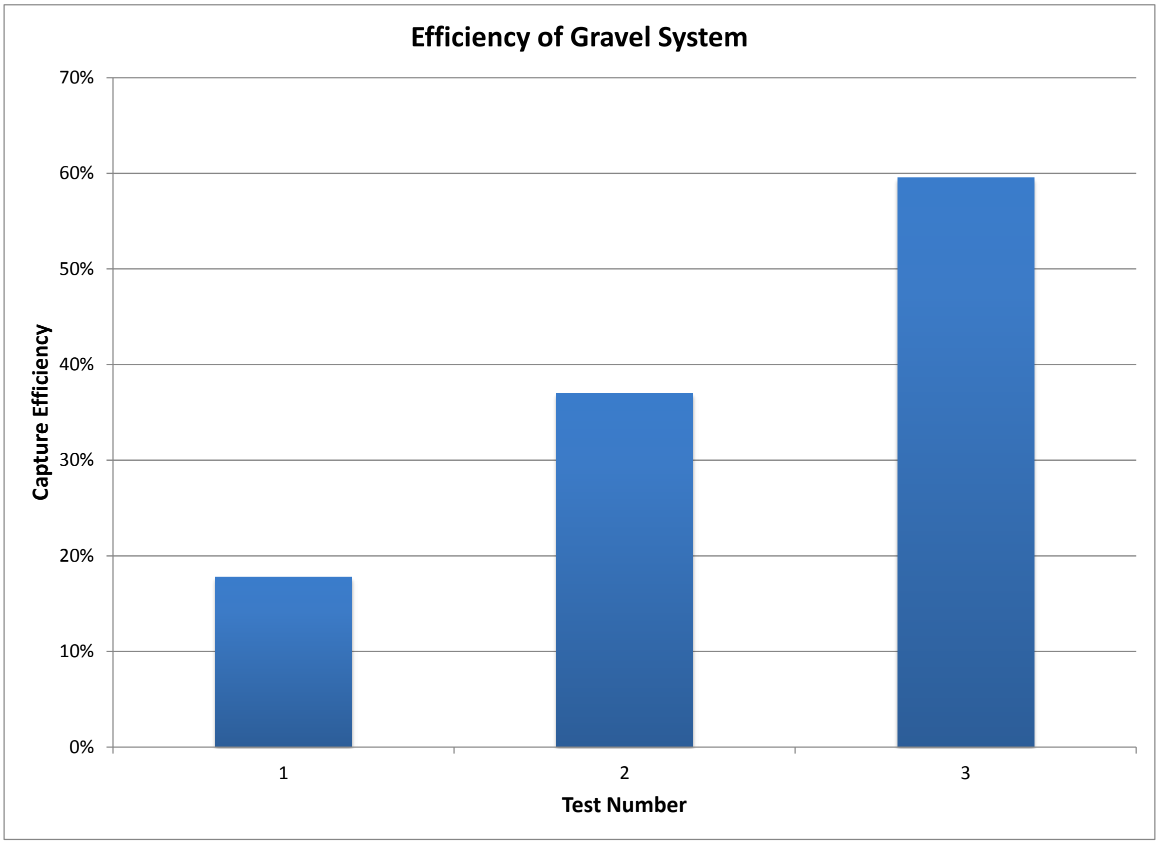


FIGURE 16. Capture efficiency results for the gravel layer only.

5.3.2 Gravel and Sand Layers

As demonstrated in FIGURE 14, the system had a layer of sand on top of the gravel, separated by a geotextile fabric. Once the gravel system testing was completed, the sand layer was added to the trenches and additional testing was performed to identify the change in capture efficiency. The test results are summarized in TABLE 13 and FIGURE 17, while more detailed test logs can be found in Appendix C. The tests used a flow meter to measure the volume of water applied evenly to the three trenches. An application volume of 30 gallons per test over the entire area was used for the first two tests and then was increased to 40 gallons due to small collection volumes observed. Both the 30 gallon application volume and the 40 gallon application volume are similar to the required irrigation over the study area based on the EPA water budget tool (2015).

Capture efficiency slightly lower than observed during the gravel testing was expected due to the void space provided by the sand layer. The first two tests saw very little return compared to the volume applied and ponding was observed above the system, demonstrating that the infiltration rate was not as high as the application rate.

TABLE 13. Summary of Capture Efficiency for Sand and Gravel Layers

Test No.	Volume Applied (gallons)	Volume Collected (gallons)[1]	Efficiency	Change in Efficiency[2]	Days Since Last Test
1	30	0.62	2%	-36%	-
2	30	0.31	1%	-37%	3
3	40	4.52	11%	-27%	6
4	40	7.70	19%	-19%	2
	Average:	3.29	8%	-	-

[1] Volume collected one hour after application.

[2] Compared to the average test involving sand only.

The low observed capture efficiency may be due to ambient temperature on days between tests. The heat caused the system to completely dry, thus some of the volume was retained by the media during the saturation process. The pores within the gravel and sand particles retained more water when they are completely dry. The first two tests were conducted a great deal of time after the gravel tests due to the construction period. The application volume was increased to 40 gallons for the last two tests so that additional data could be collected for analysis.

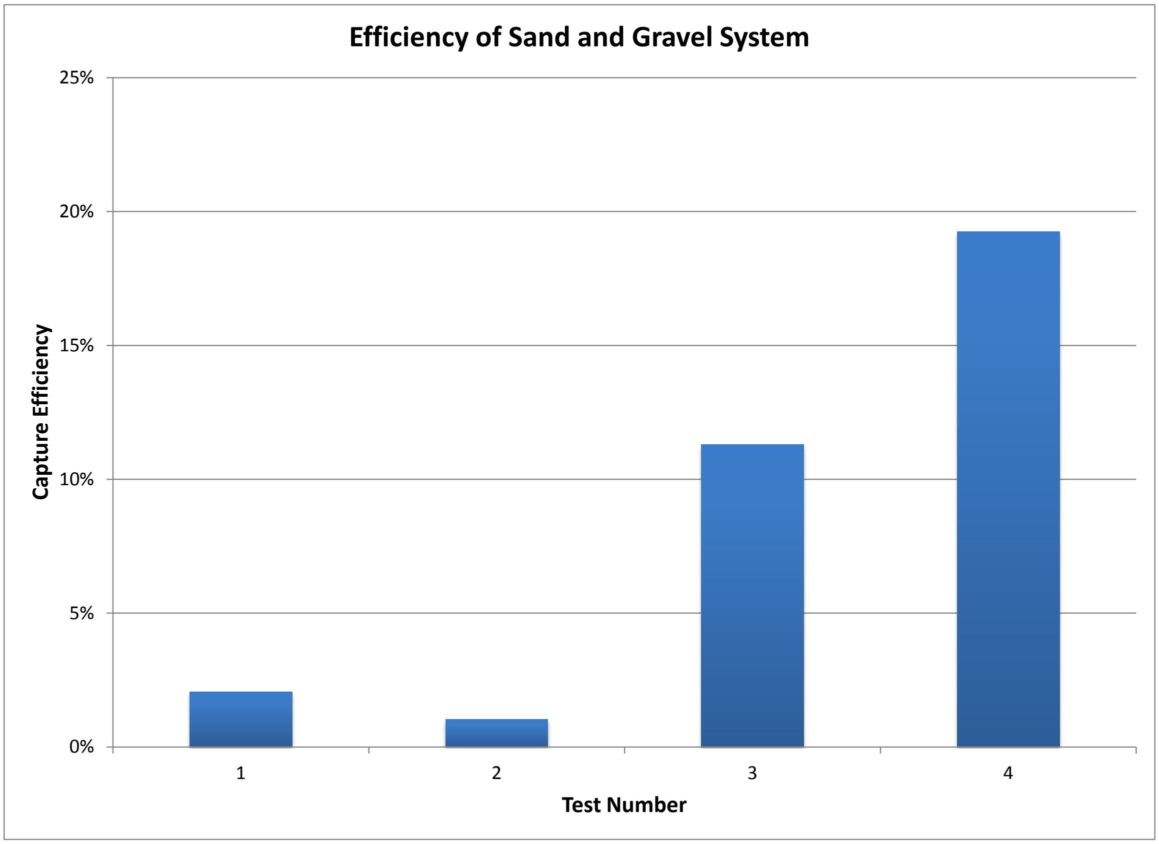


FIGURE 17. Capture efficiency results for the sand and gravel layers only.

5.3.3 Completed System

After the sand and gravel system was tested, the soil was added to the system as originally designed. An undocumented test was conducted to check if flows would saturate the system and still reach the outlet. Once water was applied to the system it became very obvious that flows would not reach the outlet due to the low permeability soils found at the site. The native soils at the site within the Manor were slightly different than the samples collected and analyzed in the laboratory because they were collected in a nearby area. It was assumed the characteristics of the soil would be similar, but this was not the case. Additionally, the sod overlaid on the system was from the local nursery, not necessarily the same sod found on site. The water applied to the system ponded above the clayey soil and did not completely infiltrate within 24 hours.

The design of the system was revised so that it would function as intended and the soil layer was removed, as shown in FIGURE 15. In the future, a planting soil or engineered soil media may be used instead of native soils. The revision increased the depth of sand in the system and applied the sod directly onto the sand, as this was a feasible option discussed with landscape professionals. The test results are summarized in TABLE 14 and FIGURE 18, while more detailed test logs can be found in Appendix C. A flow meter was used to measure the volume of water applied evenly to the three trenches, using similar methods as previous tests. Thirty gallons was applied to the system during each testing event. This volume is consistent with the previous tests and also with the irrigation needs determined by the EPA water budget tool over the study area (2015). More extensive testing was conducted for the complete system, as the entire system will help prove or disprove the hypothesis that the system could reduce the use of potable water for irrigation in the range of 15 to 30 percent.

TABLE 14. Summary of Capture Efficiency for the Complete System with Sod

Test No.	Volume Applied (gallons)	Volume Collected (gallons)[1]	Efficiency	Change in Efficiency[2]	Days Since Last Test
1	30	3.34	11%	+3%	-
2	30	1.14	4%	-4%	5
3	30	2.98	10%	+2%	2
4	30	0.00	0%	-8%	3
5	30	3.13	10%	+2%	2
6	30	3.79	13%	+5%	2
7	30	2.50	8%	-	5
8	30	5.50	18%	+10%	2
	Average:	2.80	9%	-	-

[1] Volume collected 24 hours after application.
[2] Compared to the average test involving sand only.

One important aspect to point out is that the collection time for the completed system was extended to 24 hours, as it was observed that the system was still discharging flows slowly after one hour. The more detailed field data provided in Appendix C identifies the volume captured after one hour. The completed system had varying capture efficiencies that generally increased as the number of tests conducted increased. This increase in observed efficiency may be due to the system remaining saturated between tests. During test number four, the system did not discharge any flows. The temperature during the test and the previous days was fairly high, but not necessarily higher than days other tests were conducted. Based on the data collected, it is assumed that if the system was in place permanently and received regular water application, it would perform better and have higher capture efficiency.

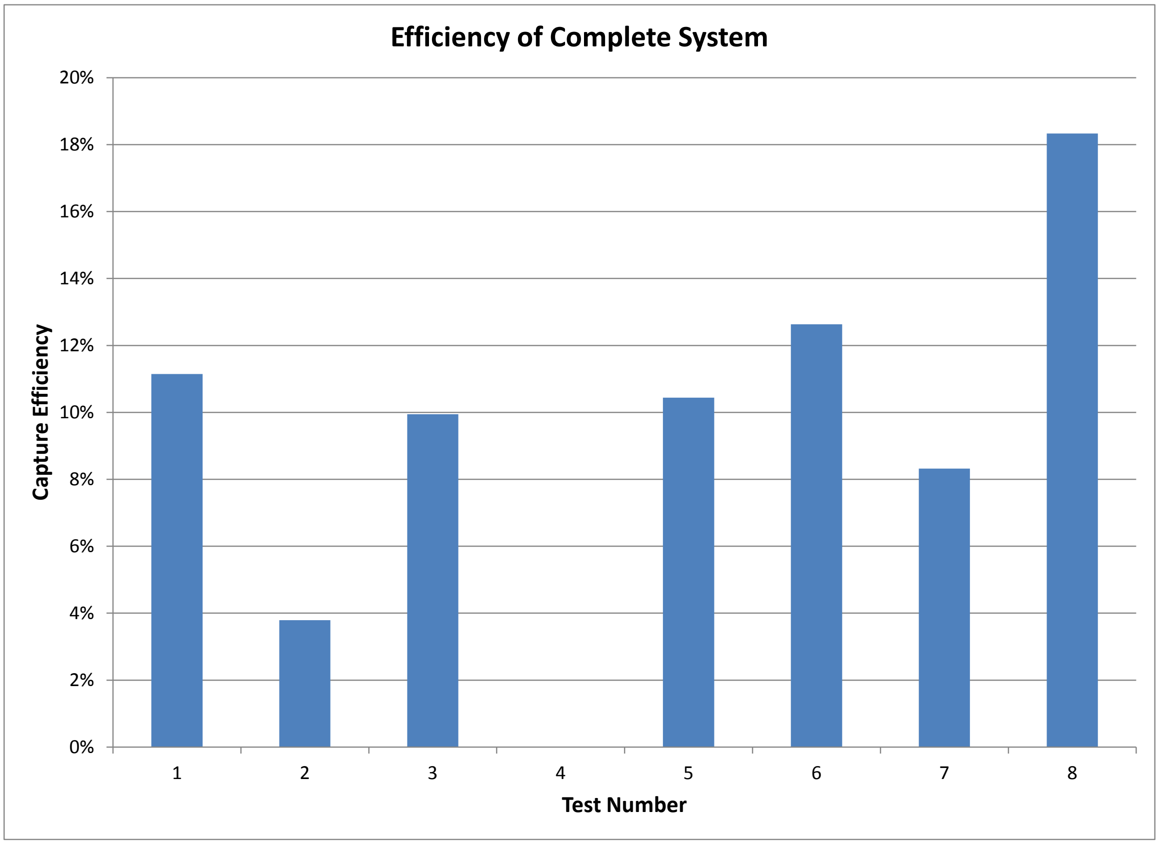


FIGURE 18. Capture efficiency results for the complete system.

The capture efficiency of the completed system was higher than it was for the system when there was only sand and gravel. It was anticipated that the addition of layers would negatively contribute to capture efficiency, but this was not the case. One reason the capture efficiency increased with the completed system was due to the sod layer on top. The sod provided some erosion protection to the system, preventing the layer from modifying the structure of the layer as water was applied. The sod also provided even dispersal throughout the system. The water was able to travel through the sod at a faster rate and minimal ponding occurred. Some ponding was observed throughout the system once the volume applied approached 30 gallons.

5.4 Obstacles

As mentioned in Section 5.3.3, one obstacle faced was the impervious nature of the soil at the Manor. The original design plans, illustrated in FIGURE 14, cited a small layer of soil on top of each of the trenches. However, when the soil was added, the conductivity of the trench decreased significantly and water ponded and did not infiltrate through the trenches. To overcome this obstacle, the soil was removed from the trenches and additional sand was placed, as shown in FIGURE 15. The sod was then placed directly on top of the sand and it was confirmed by a landscape architect that the sod would still survive without the soil layer and with proper care, as it had its own soil layer. In the future it may be more desirable to amend the existing soil in an effort to save cost on export and additional fill materials. Due to testing time constraints, the soil was replaced with sand for this study.

CHAPTER 6

PROJECTIONS

As part of this study, projections were made regarding the system cost and benefit for areas larger than the study area. A cost estimate was developed for the system to be implemented within the grassy pilot study area at the Manor, assuming design, materials, and labor had to be paid for. This cost then was used to determine a unit cost in dollars per square foot which was then applied to different sized systems. The cost estimate was developed based on similar projects in the Los Angeles area and engineering judgement. The cost estimate for the 625 square foot system implemented at the Manor is summarized in TABLE 15. Based on the cost estimate, the unit cost of the system is approximately $8.19 per square foot.

Using the unit price determined by the cost estimate, the cost of the system was determined as if it were to be implemented over areas ranging from 0.05 acres to 30 acres. For each of the projected implementation areas the anticipated annual irrigation demand was estimated based on the EPA water budget tool (2015) and the historical irrigation demand documented at the Manor, both discussed in CHAPTER 5. As a reminder, the EPA water budget tool (2015) estimated an irrigation demand of 711 gallons per month over an area of 625 square feet, or 1.14 gallons per month per square foot while the historical irrigation demand at the Manor infers irrigation demand is approximately 5.55 gallons per month per square foot.

TABLE 15. Manor System Cost Estimate.

Description	Unit	Quantity	Unit Price	Item Total
Engineering				
Design Plan and Specifications (10%)	LS	1	$460	$460
Permits (25% of Design)	LS	1	$120	$120
Construction				
Mobilization (10%)	LS	1	$420	$420
Excavation	CY	10	$6	$60
Soil Export	CY	10	$6	$60
Landscaping and Irrigation	SF	20	$2	$40
Collection Pipe	LF	50	$20	$1,000
Pump System	LS	1	$300	$300
Gravel	CF	100	$10	$1,000
Sand	CF	50	$10	$500
Geotextile	SY	40	$10	$400
Tank	EA	1	$300	$300
Contingency (10%)	LS	1	$460	$460
Total:				$5,120

The monthly irrigation demand was projected for each of the various implementation areas used in the analysis using both the EPA water budget tool projected demand and the historical Manor demand. Assuming different system efficiencies, the volume captured was projected along with the cost savings. The savings was determined based on the Long Beach Water Department Water Bill Estimator (2015) assuming an irrigation customer type and a water meter size of 1½-inches. An annual savings was then determined and the amount of years to pay off the system was determined. These projections were made assuming a capture efficiency of 7, 10, 15, 20, 25, 30, 35, 40, 45, and 50 percent. TABLE 16 and TABLE 17 summarize the results assuming 20 percent capture efficiency for the EPA water budget tool demand (2015) and the historical Manor use respectively. The graphical results for all scenarios are provided in FIGURE 19 and FIGURE 20. The tables and figures for all of the assumed capture efficiencies are provided in Appendix D.

6.1 Discussion

The projections demonstrate that the designed system is not likely to be paid off during its life cycle, which is expected to be approximately fifty years. When the historical Manor irrigation demand is the water application metric for success of the design, the results are more favorable because additional water is applied and is available to be captured. The EPA water budget tool (2015) recommended irrigation demand represents the amount of water that should be used to sustain the groundcover at the Manor. Significant savings could be accomplished by watering less as there would be a lower water bill and no additional capital cost.

Implementing this type of system with stormwater as the main source of flows would be more beneficial and is widely implemented throughout the United States and in other parts of the world. Capturing stormwater has additional benefits as the water captured for future use was not originally paid for, which is the case with potable water used for irrigation. The projections presented help quantify the benefit of the project under various conditions, however, large scale implementation of the current design do not correlate with significant cost savings.

TABLE 16. System Projections Assuming 20 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	2973	$46	$4.60	$55	323
0.10	$35,684	4955	5946	$56	$5.60	$67	531
0.15	$53,527	7433	8920	$64	$6.40	$77	697
0.20	$71,369	9911	11893	$72	$7.20	$86	826
0.25	$89,211	12388	14866	$82	$8.20	$98	907
0.30	$107,053	14866	17839	$89	$8.90	$107	1002
0.35	$124,895	17344	20813	$97	$9.70	$116	1073
0.40	$142,737	19822	23786	$105	$10.50	$126	1133
0.5	$178,422	24777	29732	$125	$12.50	$150	1189
1.0	$356,844	49554	59465	$206	$20.60	$247	1444
1.5	$535,265	74331	89197	$290	$29.00	$348	1538
2.0	$713,687	99108	118929	$373	$37.30	$448	1594
2.5	$892,109	123885	148662	$459	$45.90	$551	1620
3.0	$1,070,531	148662	178394	$543	$54.30	$652	1643
3.5	$1,248,952	173438	208126	$627	$62.70	$752	1660
4.0	$1,427,374	198215	237859	$711	$71.10	$853	1673
4.5	$1,605,796	222992	267591	$794	$79.40	$953	1685
5.0	$1,784,218	247769	297323	$878	$87.80	$1,054	1693
10.0	$3,568,435	495539	594646	$1,718	$171.80	$2,062	1731
15.0	$5,352,653	743308	891969	$2,560	$256.00	$3,072	1742
20.0	$7,136,870	991077	1189293	$3,400	$340.00	$4,080	1749
25.0	$8,921,088	1238846	1486616	$4,240	$424.00	$5,088	1753
30.0	$10,705,306	1486616	1783939	$5,079	$507.90	$6,095	1756

[1] Based on Long Beach Water Department Bill Estimator (2015).

TABLE 17. System Projections Assuming 20 Percent Capture Efficiency and Historical Manor Irrigation Demand

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	24171	14503	$82	$8.20	$98	181
0.10	$35,684	36257	29005	$119	$11.90	$143	250
0.15	$53,527	48342	43508	$160	$16.00	$192	279
0.20	$71,369	60428	58011	$203	$20.30	$244	293
0.25	$89,211	72513	72513	$244	$24.40	$293	305
0.30	$107,053	84599	87016	$284	$28.40	$341	314
0.35	$124,895	96684	101519	$325	$32.50	$390	320
0.40	$142,737	120855	116021	$366	$36.60	$439	325
0.5	$178,422	241711	145027	$449	$44.90	$539	331
1.0	$356,844	362566	290053	$858	$85.80	$1,030	347
1.5	$535,265	483422	435080	$1,269	$126.90	$1,523	352
2.0	$713,687	604277	580106	$1,677	$167.70	$2,012	355
2.5	$892,109	725133	725133	$2,088	$208.80	$2,506	356
3.0	$1,070,531	845988	870159	$2,496	$249.60	$2,995	357
3.5	$1,248,952	966843	1015186	$2,907	$290.70	$3,488	358
4.0	$1,427,374	1087699	1160212	$3,318	$331.80	$3,982	358
4.5	$1,605,796	1208554	1305239	$3,727	$372.70	$4,472	359
5.0	$1,784,218	2417109	1450265	$4,138	$413.80	$4,966	359
10.0	$3,568,435	3625663	2900530	$8,235	$823.50	$9,882	361
15.0	$5,352,653	4834217	4350795	$12,334	$1,233.40	$14,801	362
20.0	$7,136,870	6042771	5801061	$16,434	$1,643.40	$19,721	362
25.0	$8,921,088	7251326	7251326	$20,535	$2,053.50	$24,642	362
30.0	$10,705,306	24171	8701591	$24,632	$2,463.20	$29,558	362

[1] Based on Long Beach Water Department Bill Estimator (2015).

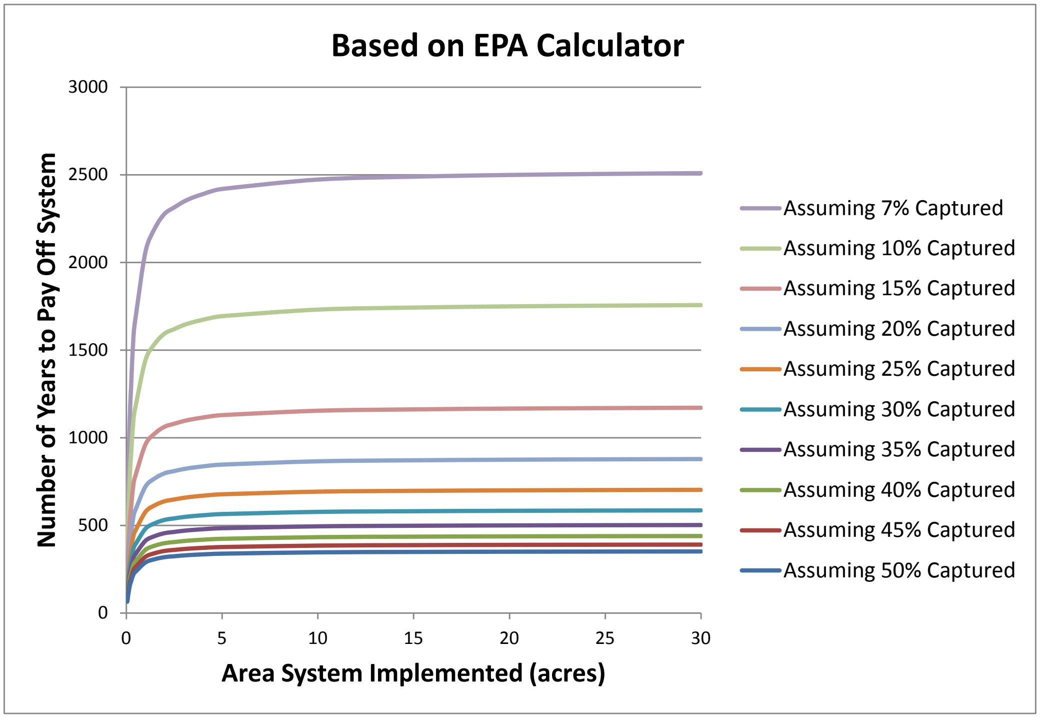


FIGURE 19. Payback period assuming EPA (2015) irrigation demand.

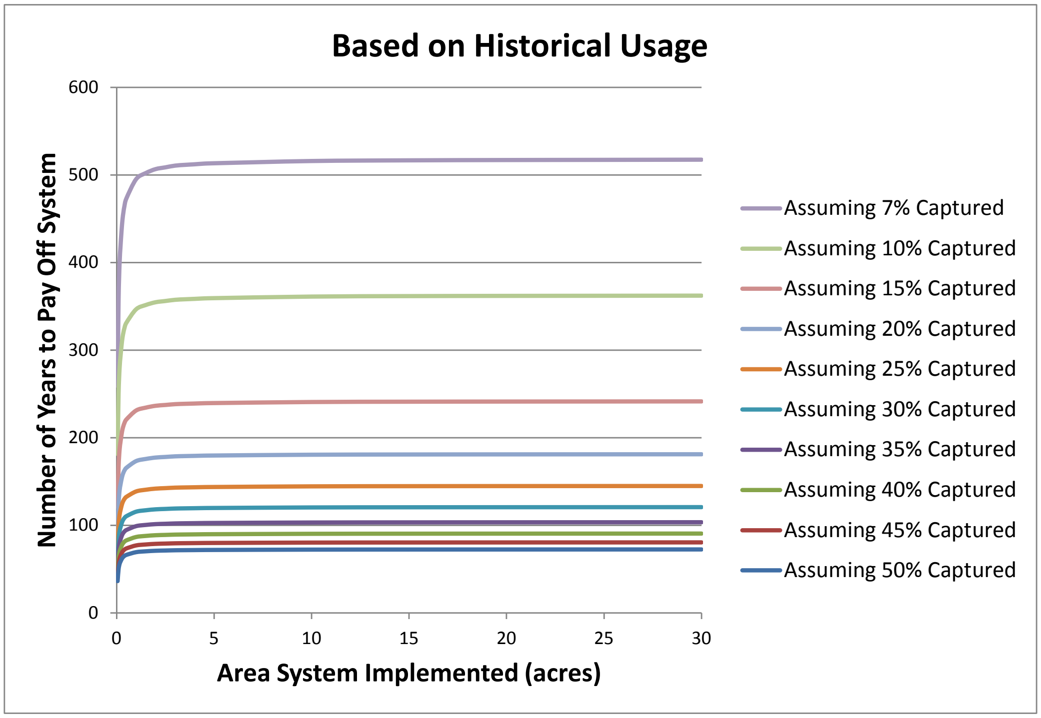


FIGURE 20. Payback period assuming Manor historical irrigation demand.

CHAPTER 7

SYSTEM MODELING

Throughout the construction and testing of the subsurface irrigation collection system at the Manor, modifications were noted for future studies. Hydrus 2D, a software developed for modeling solute transport in saturated and partially saturated media, was used to model some of these alternative scenarios so that the construction could be optimized and capture efficiency could be estimated. The model was developed to closely mimic the field conditions at the site; however some of the soil characteristics were unknown as they were not measured in the laboratory, and thus some assumptions were made. These assumptions are documented throughout this section. Once a baseline simulation was run, alternative scenarios were developed and the results were compared. The model was used to evaluate the following scenarios: 1) varying media ratios between the sand and gravel layers; 2) alternative depths of the system; and 3) different irrigation frequencies and durations. This chapter discusses the different scenarios modeled using Hydrus 2D and presents the findings.

7.1 Baseline Simulation

Baseline conditions were simulated in Hydrus 2D and the results from alternative scenarios were compared to the results of the baseline simulation. The baseline simulation closely resembles the design of the system at the Manor. The system was modeled in 2D, looking at one trench cross section. The system modeled was approximately three feet deep (one meter) with a two foot deep gravel layer (0.682 meters) overlain by a one foot deep sand layer (0.318 meters). The characteristics of the sand and gravel were not determined through laboratory experiments; therefore typical values were used and are summarized in TABLE 18.

TABLE 18. Material Properties Used in Hydrus 2D.

Material	Θ_r[1]	Θ_s[2]	α[3]	n[4]	K_s[5]
Sand	0.045	0.41	8.5	1.95	0.3
Gravel	0.000	0.30	15.0	5.00	8.0

[1] Residual water content (Hydrus 2D Library).
[2] Saturated water content (Hydrus 2D Library).
[3] Related to the inverse of the air entry suction (Genuchten 1991).
[4] Measure of the pore size distribution (Genuchten 1991).
[5] Saturated hydraulic conductivity (Todd 2005).

Precipitation input was used to simulate an irrigation event in the model. The top of the system was assigned atmospheric boundary conditions and irrigation was applied at a rate of 0.25 feet per hour (0.075 meters per hour) for a total of one hour resulting in an irrigation event with a volume of 88 gallons over the three trenches. This is higher than the amount applied at the Manor during testing so that more measurable results were produced for comparison purposes. The boundary conditions at the bottom of the media were specified as free drainage, allowing water to leave the system. The model output was analyzed to determine the volume leaving the system assuming all three trenches were being utilized. A 24 hour simulation was run for the baseline condition, similar to the collection timeframe at the Manor. The baseline simulation results are summarized in TABLE 19. The model uses metric units; therefore the metric and imperial units are both provided. The input and output files for the baseline simulation are provided in Appendix E. It is important to point out that evaporation, evapotranspiration, root uptake, and temperature were not considered in the model, but will influence the results in the field. It would be expected that the capture efficiency in the field would be less than that found in the model, as the evaporation, evapotranspiration, and root uptake would result is greater losses.

TABLE 19. Hydrus 2D Baseline Simulation Summary.

Sand Depth	Gravel Depth	Irrigation Rate	Irrigation Duration	Volume Added	Volume Captured	Capture Efficiency
0.32 m	0.68 m	0.075 m/hr	1 hr	0.33 m^3	0.11 m^3	34%
1.04 ft	2.24 ft	0.246 ft/hr	1 hr	11.81 ft^3 (88.4 gal)	4.03 ft^3 (30.1 gal)	34%

7.2 Varied Media Ratios

Hydrus 2D was used to model the system with different sand to gravel ratios. The total media depth remained constant along with the applied irrigation event and the total simulation time (24 hours). Four alternative scenarios were simulated. The input and output are presented in TABLE 20 and TABLE 21 in imperial and metric units respectively. The results assume three trenches are utilized and sized consistently with the system at the Manor. FIGURE 21 illustrates the relationship determined using Hydrus 2D.

As anticipated, the results for varied media ratios demonstrate that the system is more efficient as the ratio between sand and gravel approaches zero. The gravel provides additional void spaces and moves the water through and out of the system while the sand is denser and slows down the movement of water. A best fit line was fit to the data points and the data was linearized in logarithmic scale. As expected, a system with all gravel would essentially operate the most efficiently based on this analysis, however that is not feasible as the vegetation cannot establish in gravel only. The minimum sand depth to support vegetation is four inches. A four inch gravel layer in the modeled system (total depth of 3.28 feet) would relate to the minimum sand to gravel ratio of 10 percent. Based on this conclusion, the optimized system would capture approximately 80 percent of the water added.

TABLE 20. Model Results for Varied Media Ratios in Imperial Units.

Scenario	Depth (ft)	% Sand	% Gravel	Volume Added (gal)	Volume Captured (gal)	Capture Efficiency	% Change
Baseline	3.28	32	68	88.3	30.1	34%	-
1	3.28	14	86	88.3	58.9	67%	+33%
2	3.28	23	77	88.3	42.5	48%	+14%
3	3.28	41	59	88.3	17.2	20%	-15%
4	3.28	50	50	88.3	4.8	5%	-29%

TABLE 21. Model Results for Varied Media Ratios in Metric Units.

Scenario	Depth (m)	% Sand	% Gravel	Volume Added (m^3)	Volume Captured (m^3)	Capture Efficiency	% Change
Baseline	1.00	32	68	0.33	0.11	34%	-
1	1.00	14	86	0.33	0.22	67%	+33%
2	1.00	23	77	0.33	0.16	48%	+14%
3	1.00	41	59	0.33	0.07	20%	-15%
4	1.00	50	50	0.33	0.02	5%	-29%

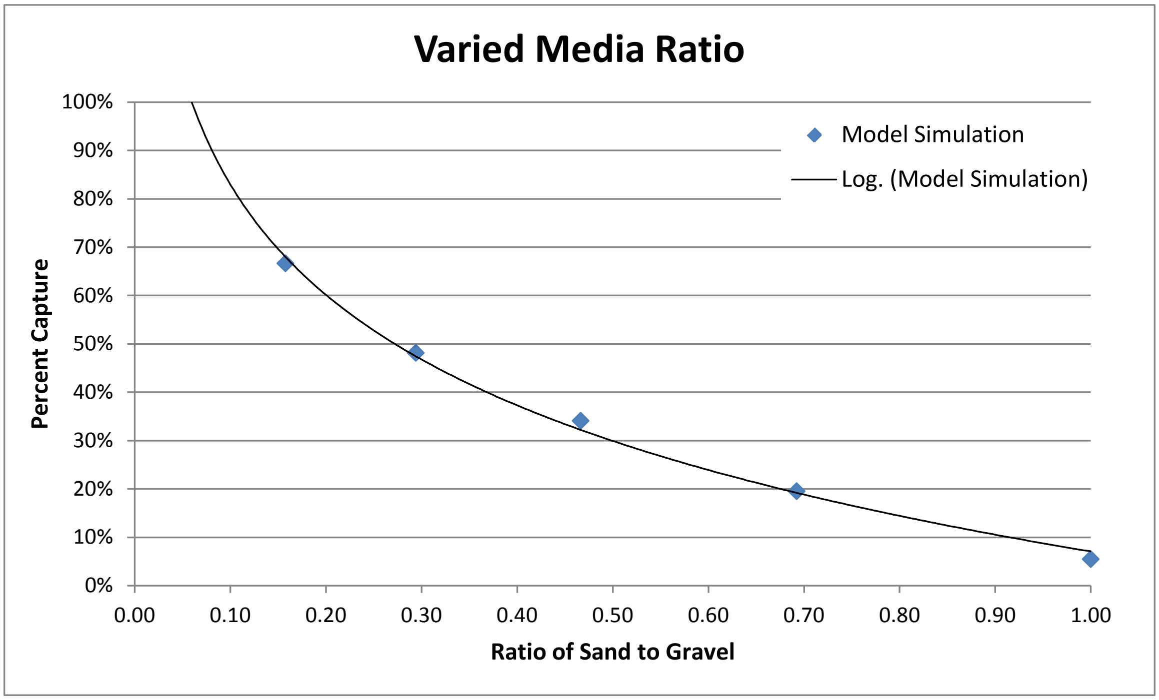


FIGURE 21. Hydrus 2D results for varied media ratios.

7.3 Varied System Depths

Hydrus 2D was also used to analyze how the system would function at different media depths. For this analysis the sand to gravel ratio remained constant along with the irrigation pattern and simulation period. The media ratio was consistent with the baseline model previously discussed and irrigation was applied at a rate of 0.25 feet per hour (0.075 meters per hour) for a total of one hour. The simulation timeframe was one hour. TABLE 22 and TABLE 23 summarize the model input and output for the baseline conditions and three alternatives in imperial and metric units respectively. The simulations represent the system assuming three trenches are utilized and sized as previously described. FIGURE 22 illustrates the relationship determined using Hydrus 2D.

The results from varied system depths demonstrate that the capture efficiency increases as the depth decreases. A best fit line was fit to the data points obtained through the model and a linear relationship was found. As expected, a system with a depth close to zero would perform the best as the flows would enter and leave and there would be no chance for flows to be lost. This is obviously not a feasible option. The minimum thickness of the sand layer alone to support vegetation is four inches and gravel would be required at a minimum around the pipe. The gravel layer would have to be thicker than the collection pipe. The minimum and optimal depth would be approximately one foot.

TABLE 22. Model Results for Varied Depths in Imperial Units.

Scenario	Depth (ft)	Depth Sand (ft)	Depth Gravel (ft)	Volume Added (gal)	Volume Captured (gal)	Capture Efficiency	% Change
Baseline	3.28	1.04	2.24	88.3	30.1	34%	-
1	1.97	0.63	1.34	88.3	51.3	58%	+24%
2	2.63	0.84	1.79	88.3	40.7	46%	+12%
3	3.94	1.25	2.68	88.3	19.3	22%	-12%

TABLE 23. Model Results for Varied Depths in Metric Units.

Scenario	Depth (m)	Depth Sand (m)	Depth Gravel (m)	Volume Added (m^3)	Volume Captured (m^3)	Capture Efficiency	% Change
Baseline	1.00	0.32	0.68	0.33	0.11	34%	-
1	0.60	0.19	0.41	0.33	0.19	58%	+24%
2	0.80	0.26	0.54	0.33	0.15	46%	+12%
3	1.20	0.38	0.82	0.33	0.07	22%	-12%

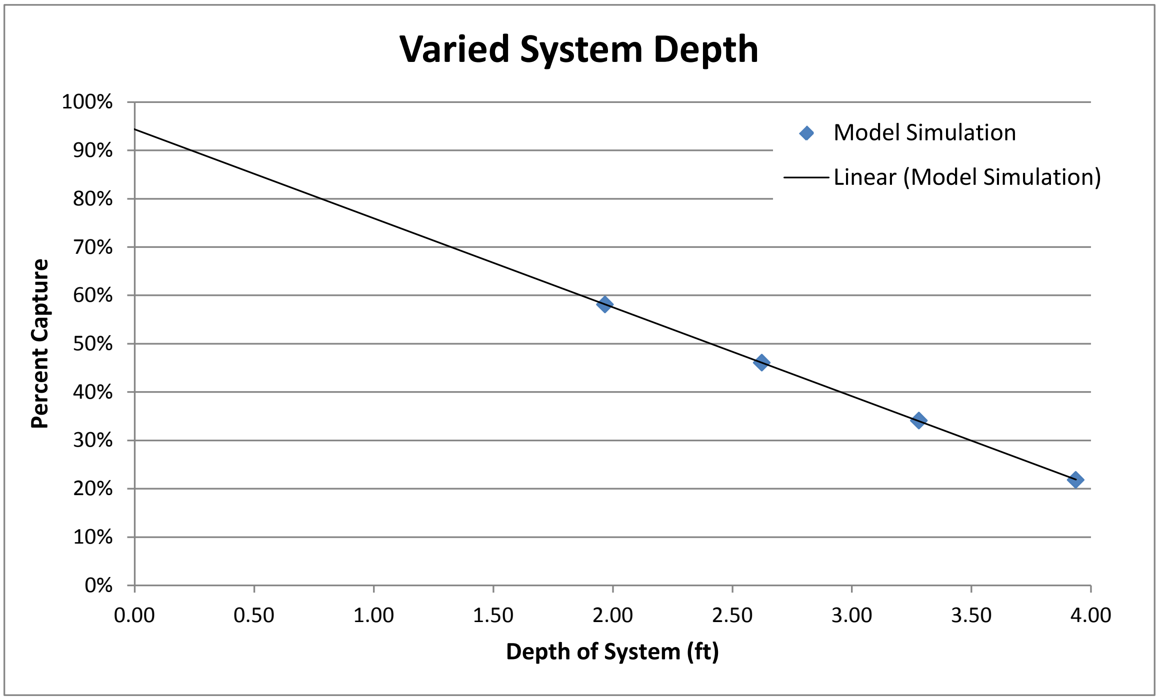


FIGURE 22. Hydrus 2D results for varied system depths.

7.4 Optimized Media Ratio and System Depth

The results presented in Section 7.2 and 7.3 demonstrate that the optimized system would have a minimum sand to gravel media ratio of 10 percent and a depth greater than one foot. Parameters close to these limits were evaluated to optimize the system. The most desirable system will use least amount of sand that will still allow for turf establishment. A sand depth of four inches and a media ratio of 10 percent results in a system depth of 3.33 feet (40 inches). This is not the optimal scenario. Using the minimum sand layer thickness with a ratio of 20 to 25 percent would suggest using a system around 1.7 feet deep. This scenario was modeled to determine how the more optimal system would perform.

Using the same general parameters as the varied media ratio and varied system depth models, the optimized simulation demonstrated a capture efficiency of 73 percent. The capture efficiency based on this system is greater than any of the previous simulations. The results match the expectations of this design, which represents an optimized system.

7.5 Varied Irrigation Frequency

Lastly, Hydrus 2D was used to analyze how the system would function under different irrigation frequencies and durations. For this analysis, the sand to gravel ratio, the system depth, and simulation period remained constant. The media ratio and total depth is consistent with the baseline model previously discussed (32 percent sand, 68 percent gravel, and total depth of 3.28 feet or one meter). The baseline simulation was extended for 168 hours, or one full week. Under baseline conditions, irrigation events occurred four times per week. TABLE 24 and TABLE 25 summarize the model input and output for the baseline conditions and seven alternatives in imperial and metric units respectively. The simulations represent the system assuming three trenches are utilized and sized as previously discussed. FIGURE 23 illustrates the relationship determined using the data obtained with Hydrus 2D.

TABLE 24. Model Results for Varied Irrigation Patterns in Imperial Units.

Scenario	Events per Week	Irrigation Rate (ft/hr)	Irrigation Duration (hr)	Volume Added (gal)	Volume Captured (gal)	Capture Efficiency	% Change
Baseline	4	0.246	1	353.4	294.1	83%	-
1	2	0.246	1	176.7	127.6	72%	-11%
2	3	0.246	1	265.0	205.9	78%	-6%
3	7	0.246	1	618.4	552.1	89%	+6%
4	2	0.131	1	94.2	45.1	48%	-35%
5	3	0.131	1	141.4	81.9	58%	-25%
6	4	0.131	1	188.5	129.5	69%	-15%
7	7	0.131	1	329.8	268.0	81%	-2%

TABLE 25. Model Results for Varied Irrigation Patterns in Metric Units.

Scenario	Events per Week	Irrigation Rate (m/hr)	Irrigation Duration (hr)	Volume Added (m^3)	Volume Captured (m^3)	Capture Efficiency	% Change
Baseline	4	0.075	1	1.34	1.11	83%	-
1	2	0.075	1	0.67	0.48	72%	-11%
2	3	0.075	1	1.00	0.78	78%	-6%
3	7	0.075	1	2.34	2.09	89%	+6%
4	2	0.040	1	0.36	0.17	48%	-35%
5	3	0.040	1	0.54	0.31	58%	-25%
6	4	0.040	1	0.71	0.49	69%	-15%
7	7	0.040	1	1.25	1.01	81%	-2%

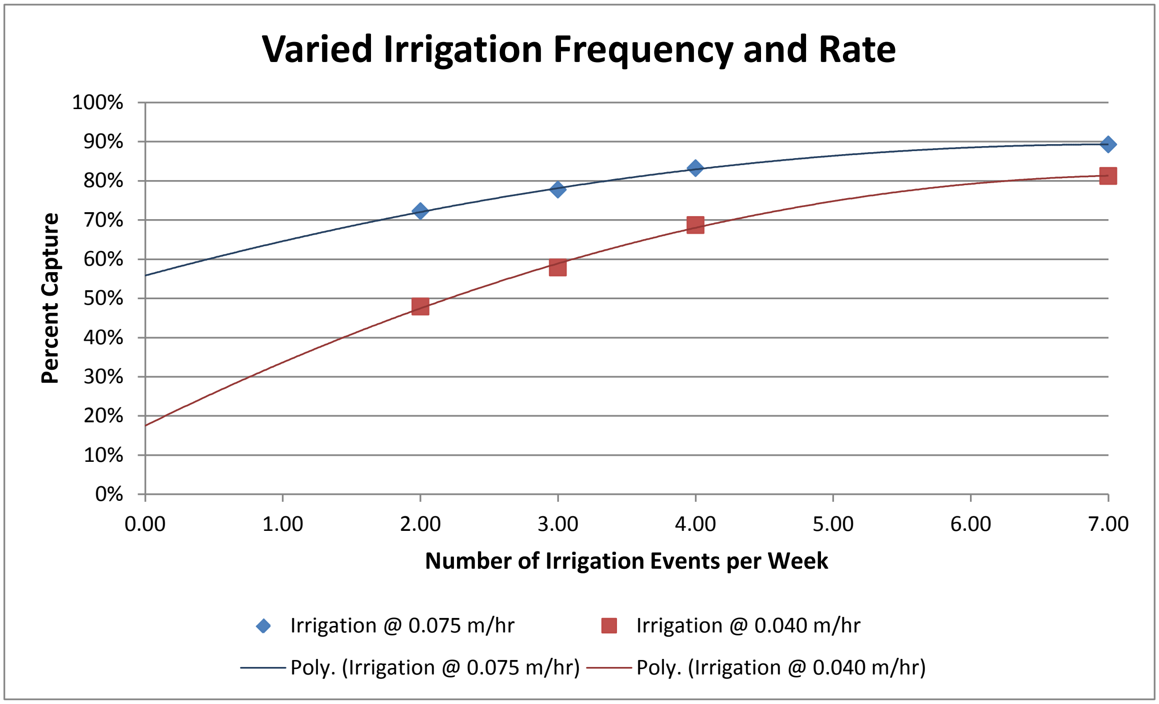


FIGURE 23. Hydrus 2D results for varied irrigation frequency and rate.

The results from varied irrigation frequency and rate show that the capture efficiency increases with more frequent irrigation events. The results also show that the capture efficiency increases when more water is added to the system. As more water is added to the system, less is lost to saturation and seepage because the system is still saturated from the previous event. These results are conflicting in that the system is designed to conserve water, but adding additional water so that the output is greater does not necessarily conserve water. Polynomial functions were used to develop a best fit curve with the data points determined using Hydrus 2D and the corresponding equations are shown in the figure.

CHAPTER 8

FUTURE STUDIES AND RECOMMENDATIONS

Throughout the construction and testing process at the Manor, various alternative design concepts were identified and later modeled in Hydrus 2D. The results from the Hydrus 2D model, along with work experience, contribute to the future studies and recommendations outlined in this chapter. These recommendations should improve the design of the system and help achieve a greater capture efficiency rate, thus further reducing the potable water required to continue irrigating the Manor or any other facility that implements the system.

One future recommendation would be to make the system shallower. The depth of gravel (subsurface media) does not need to be as deep as it was at the Manor. The additional depth provides some storage, but it also introduces more opportunities for water to be lost through seepage and absorption. The media depth should be just deep enough that the plants used have enough room for roots to sustain. Additionally, the system should use a collection system larger than a perforated pipe. Different stormwater equipment companies, such as Atlantis Corporation, manufacture modular drainage panels that would allow flows to be collected over a larger area, thus concentrating flows in a small pipe would not be necessary. The entire bottom of the trench could be lined with Flo-Cells to help improve the capture efficiency. The product being suggested is illustrated in FIGURE 24.

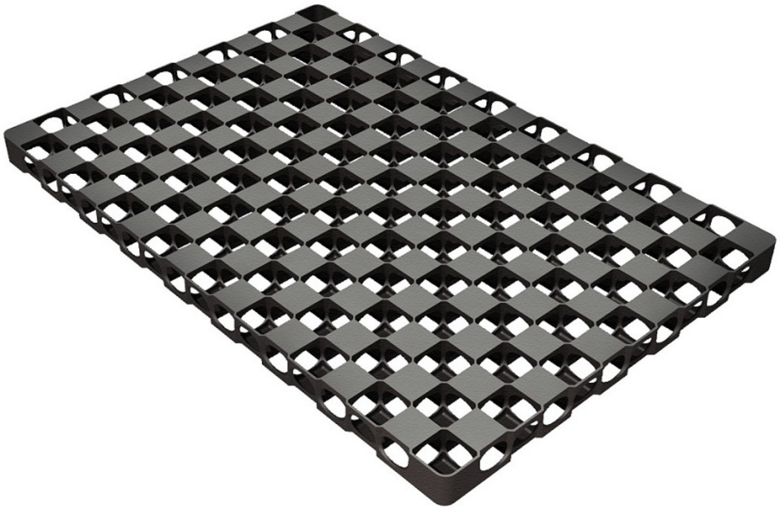


FIGURE 24. Flo-Cell by Atlantis Corporation.

Additional research regarding soil amendments should be conducted in hopes of coming up with solutions that address poor existing on-site soil conditions. The total cost of the system could be minimized and the efficiency could be improved if on-site soil can be amended so that it can be used with the system. Tests could also be conducted using different types and grain size distributions of sand and gravel. The relationship between grain size and capture efficiency should be evaluate and optimized. Different types of sod and planting could also be evaluated and optimized.

Future studies that implement gray water collection and treatment along with the excess subsurface irrigation collection system should also be reinforced in greater detail. The impact of introducing gray water should be analyzed and a cost benefit analysis could be performed.

APPENDICES

APPENDIX A

LABORATORY PROTOTYPE DESIGN PLANS

Images of these design plans are available as supplemental files to this manuscript in ProQuest Dissertations and Theses database.

APPENDIX B

MANOR SYSTEM DESIGN PLANS

Images of these design plans are available as supplemental files to this manuscript in ProQuest Dissertations and Theses database.

APPENDIX C

DETAILED TESTING DATA FROM MANOR

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 1 - Gravel Only

Date: 7/10/2014
Time: 2:30 PM
Weather: > 80°F - hot and sunny
Volume applied: 20 gal
Time applied: 1 min, 50 sec
Time until first drop: 1 min, 50 sec
Collection time: 30 min
Volume collected: 2.39 gal

Depth of water in bucket: 2 in = 0.111 cf = 0.83 gal
3.25 in = 0.181 cf = 1.35 gal
0.5 in = 0.028 cf = 0.21 gal

Notes: First test - ground needed to be saturated therefore a lot of water was absorbed by materials

Volume applied: 10 gal
Time applied: 2 min, 1 sec
Time until first drop: 2 min, 17 sec
Collection time: 30 min
Volume collected: 2.94 gal

Depth of water in bucket: 2.75 in = 0.153 cf = 1.14 gal
4.3 in = 0.240 cf = 1.80 gal

Total Volume Collected: 5.33 gal
% Reclaimed: 18%

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 2 - Gravel Only

Date: 7/11/2014
Time: 2:35 PM
Weather: > 80°F - hot and sunny
Volume applied: ? gal
Time applied: -
Time until first drop: -
Collection time: - min
Volume collected: - gal

Depth of water in bucket:

Notes: Flow meter was not functioning properly therefore the volume applied
was unknown and the test was haulted
System was still dripping from previous day

Volume applied: gal
Time applied:
Time until first drop:
Collection time: min
Volume collected: gal

Depth of water in bucket:

Total Volume Collected: **gal**
% Reclaimed:

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 3 - Gravel Only

Date: 7/15/2014
Time: 2:45 PM
Weather: > 70°F - overcast
Volume applied: 20 gal
Time applied: 2 min, 27 sec
Time until first drop: 2 min, 12 sec
Collection time: 30 min
Volume collected: 5.12 gal

Depth of water in bucket: 6.1 in = 0.343 cf = 2.57 gal
4.25 in = 0.238 cf = 1.78 gal
1.87 in = 0.104 cf = 0.77 gal

Notes: system collected more than the first test may be due to the system maintaining moisture

Volume applied: 10 gal
Time applied: 1 min, 36 sec
Time until first drop: 1 min, 31 sec
Collection time: 30 min
Volume collected: 5.99 gal

Depth of water in bucket: 6.05 in = 0.340 cf = 2.55 gal
4.75 in = 0.266 cf = 1.99 gal
3.5 in = 0.195 cf = 1.46 gal

Total Volume Collected: 11.11 gal
% Reclaimed: 37%

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 4 - Gravel Only

Date: 7/17/2014
Time: 2:35 PM
Weather: > 80°F - hot and sunny
Volume applied: ? gal
Time applied: -
Time until first drop: -
Collection time: - min
Volume collected: - gal

Depth of water in bucket:

Notes: Flow meter was not functioning properly therefore the volume applied was unknown and the test was haulted

Volume applied: gal
Time applied:
Time until first drop:
Collection time: min
Volume collected: gal

Depth of water in bucket:

Total Volume Collected: **gal**
% Reclaimed:

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 5 - Gravel Only

Date: 7/22/2014
Time: 2:45 PM
Weather: > 70°F - overcast
Volume applied: 20 gal
Time applied: 4 min, 30 sec
Time until first drop: 2 min, 25 sec
Collection time: 30 min
Volume collected: 10.53 gal

Depth of water in bucket: 9 in = 0.512 cf = 3.83 gal
9 in = 0.512 cf = 3.83 gal
6.8 in = 0.384 cf = 2.87 gal

Notes: volume collected increased again

Volume applied: 10 gal
Time applied: 1 min, 54 sec
Time until first drop: 1 min, 22 sec
Collection time: 30 min
Volume collected: 7.33 gal

Depth of water in bucket: 7.9 in = 0.448 cf = 3.35 gal
9.35 in = 0.533 cf = 3.98 gal

Total Volume Collected: 17.86 gal
% Reclaimed: 60%

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 1 - Gravel and Sand

Date: 8/10/2014
Time: 9:15 AM
Weather: cool, sunny
Volume applied: 30 gal
Time applied: 8 min, 40 sec
Time until first drop: plus 1-2 min
Collection time: 45 min
Volume collected: 0.62 gal

Depth of water in bucket: 1.5 in = 0.083 cf = 0.62 gal

Notes: pipe came out of junction at the beginning - lost first flush of water collected

Total Volume Collected: **0.62 gal**
% Reclaimed: **2%**
Application flow rate: **3.46 gpm** = 0.007713 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 2 - Gravel and Sand

Date: 8/13/2014
Time: 2:30 PM
Weather: hot
Volume applied: 30 gal
Time applied: 19 min, 23 sec
Time until first drop: plus 2 min, 28 sec
Collection time: 45 min after first drop
Volume collected: 0.31 gal

Depth of water in bucket: 0.75 in = 0.041 cf = 0.31 gal

Notes:

Total Volume Collected: **0.31 gal**
% Reclaimed: **1%**
Application flow rate: **1.55 gpm** = 0.003449 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 3 - Gravel and Sand

Date: 8/19/2014
Time: 2:40 PM
Weather: cool - 80
Volume applied: 40 gal
Time applied: 20 min, 18 sec
Time until first drop: plus 4 min, 12 sec
Collection time: 45 min
Volume collected: 2.85 gal

Depth of water in bucket: 6.75 in = 0.381 cf = 2.85 gal

Notes:

Collection time: 24 hr
Volume collected: 1.67 gal

Depth of water in bucket: 4 in = 0.223 cf = 1.67 gal

Total Volume Collected: **4.52 gal**
% Reclaimed: **11%**
Application flow rate: **1.97 gpm** = 0.00439 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 4 - Gravel and Sand

Date: 8/21/2014
Time: 2:40 PM
Weather: hot
Volume applied: 40 gal
Time applied: 20 min
Time until first drop: plus 2 min, 23 sec
Collection time: 45 min
Volume collected: 5.39 gal

Depth of water in bucket: 12.5 in = 0.721 cf = 5.39 gal

Notes: Timer malfunction - application time may be slightly off

Collection time: 24 hr
Volume collected: 2.31 gal

Depth of water in bucket: 5.5 in = 0.309 cf = 2.31 gal

Total Volume Collected: **7.70 gal**
% Reclaimed: **19%**
Application flow rate: **2.00 gpm** = 0.004456 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 1 - Complete System

Date: 9/25/2014
Time: 2:45 PM
Weather: hot
Volume applied: 30 gal
Time applied: 10 min, 49 sec
Time until first drop: plus 1 min, 29 sec
Collection time: 1 hr
Volume collected: 2.10 gal

Depth of water in bucket: 5 in = 0.280 cf = 2.10 gal

Notes:

Collection time: 24 hr
Volume collected: 1.25 gal

Depth of water in bucket: 3 in = 0.167 cf = 1.25 gal

Total Volume Collected: **3.34 gal**
% Reclaimed: **11%**
Application flow rate: **2.77 gpm** = 0.00618 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 2 - Complete System

Date: 9/30/2014
Time: 2:45 PM
Weather: warm
Volume applied: 30 gal
Time applied: 9 min, 20 sec
Time until first drop: plus 2 min, 55 sec
Collection time: 1 hr
Volume collected: 0.52 gal

Depth of water in bucket: 1.25 in = 0.069 cf = 0.52 gal

Notes:

Collection time: 24 hr
Volume collected: 0.62 gal

Depth of water in bucket: 1.5 in = 0.083 cf = 0.62 gal

Total Volume Collected: **1.14 gal**
% Reclaimed: **4%**
Application flow rate: **3.21 gpm** = 0.007162 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 3 - Complete System

Date: 10/2/2014
Time: 2:30 PM
Weather: hot (90)
Volume applied: 30 gal
Time applied: 8 min, 8 sec
Time until first drop: plus 1 min, 32 sec
Collection time: 1 hr
Volume collected: 1.80 gal

Depth of water in bucket: 4.3 in = 0.240 cf = 1.80 gal

Notes:

Collection time: 24 hr
Volume collected: 1.19 gal

Depth of water in bucket: 2.85 in = 0.158 cf = 1.19 gal

Total Volume Collected: **2.98 gal**
% Reclaimed: **10%**
Application flow rate: **3.69 gpm** = 0.008219 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 4 - Complete System

Date: 10/5/2014
Time: 4:00 PM
Weather: shade, hot
Volume applied: 30 gal
Time applied: 10 min, 12 sec
Time until first drop:
Collection time: 1 hr
Volume collected: 0.00 gal

Depth of water in bucket: in = 0.000 cf = 0.00 gal

Notes: No water was collected

Collection time: 24 hr
Volume collected: 0.00 gal

Depth of water in bucket: in = 0.000 cf = 0.00 gal

Total Volume Collected: **0.00 gal**
% Reclaimed: **0%**
Application flow rate: **2.94 gpm** = 0.006553 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 5 - Complete System

Date: 10/7/2014
Time: 2:45 PM
Weather: hot
Volume applied: 30 gal
Time applied: 10 min, 23 sec
Time until first drop: plus 2 min, 45 sec
Collection time: 1 hr
Volume collected: 1.88 gal

Depth of water in bucket: 4.5 in = 0.252 cf = 1.88 gal

Notes:

Collection time: 24 hr
Volume collected: 1.25 gal

Depth of water in bucket: 3 in = 0.167 cf = 1.25 gal

Total Volume Collected: 3.13 gal
% Reclaimed: 10%
Application flow rate: 2.89 gpm = 0.006438 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 6 - Complete System

Date: 10/9/2014
Time: 2:45 PM
Weather: hot
Volume applied: 30 gal
Time applied: 9 min, 17 sec
Time until first drop: plus 2 min, 46 sec
Collection time: 1 hr
Volume collected: 2.20 gal

Depth of water in bucket: 5.25 in = 0.295 cf = 2.20 gal

Notes:

Collection time: 24 hr
Volume collected: 1.59 gal

Depth of water in bucket: 3.8 in = 0.212 cf = 1.59 gal

Total Volume Collected: 3.79 gal
% Reclaimed: 13%
Application flow rate: 3.23 gpm = 0.007201 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 7 - Complete System

Date: 10/14/2014
Time: 2:45 PM
Weather: cool (overcast in am) <80
Volume applied: 30 gal
Time applied: 14 min, 41 sec
Time until first drop: plus 1 min, 20 sec
Collection time: 45 min
Volume collected: 1.25 gal

Depth of water in bucket: 3 in = 0.167 cf = 1.25 gal

Notes:

Collection time: 24 hr
Volume collected: 1.25 gal

Depth of water in bucket: 3 in = 0.167 cf = 1.25 gal

Total Volume Collected: **2.50 gal**
% Reclaimed: **8%**
Application flow rate: **2.04 gpm** = 0.004552 cfs

AMERICAN GOLD STAR MANOR IRRIGATION RECYCLING FIELD TESTS

Test 8 - Complete System

Date: 10/16/2014
Time: 2:30 PM
Weather: cool
Volume applied: 30 gal
Time applied: 13 min, 44 sec
Time until first drop: plus 54 sec
Collection time: 55 min
Volume collected: 3.83 gal

Depth of water in bucket: 9 in = 0.512 cf = 3.83 gal

Notes:

Collection time: 24 hr
Volume collected: 1.67 gal

Depth of water in bucket: 4 in = 0.223 cf = 1.67 gal

Total Volume Collected: **5.50 gal**
% Reclaimed: **18%**
Application flow rate: **2.18 gpm** = 0.004867 cfs

APPENDIX D

SYSTEM PROJECTION SUMMARIES

System Projections Assuming 7 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

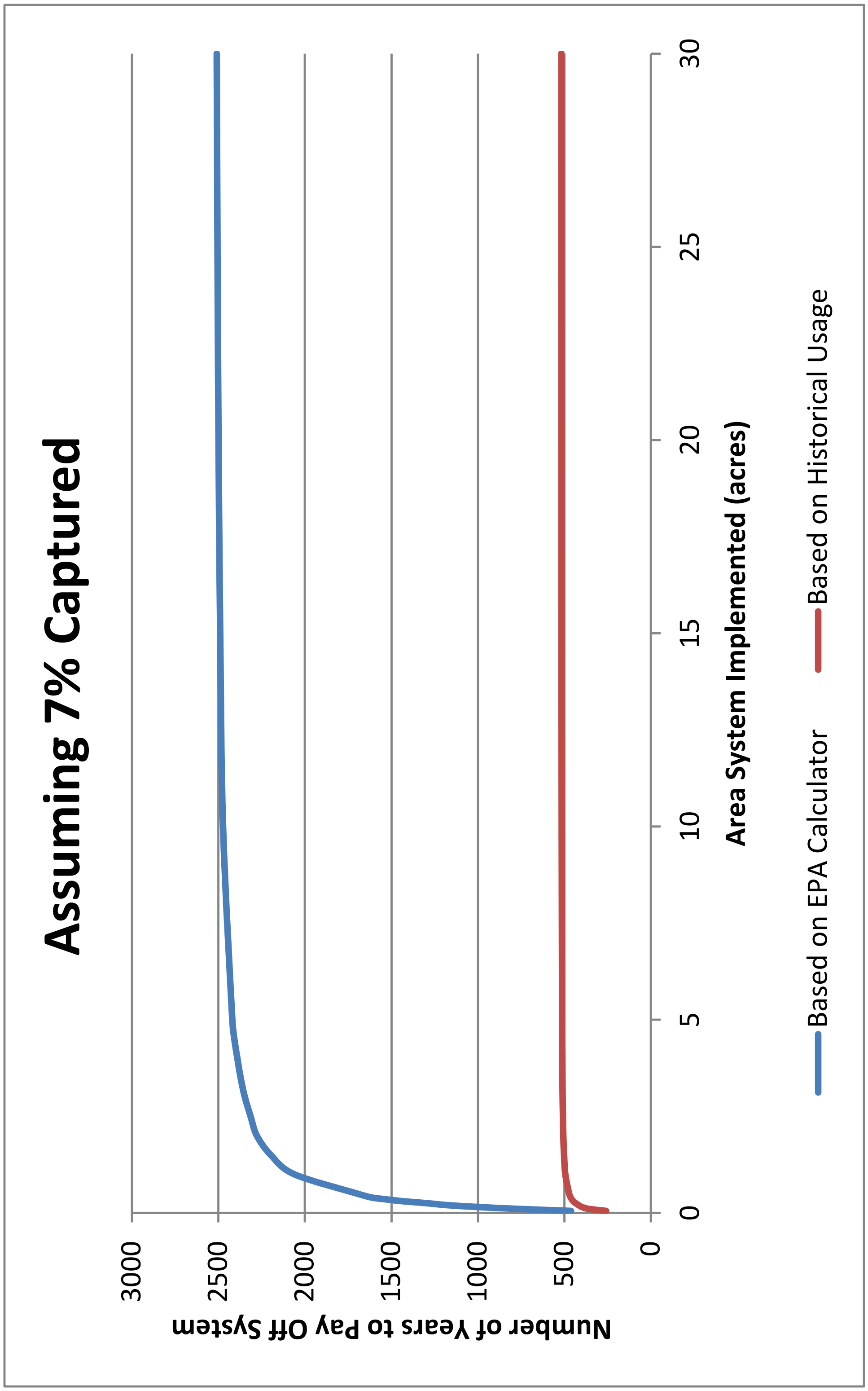
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	2081	$46	$3.22	$39	462
0.10	$35,684	4955	4163	$56	$3.92	$47	759
0.15	$53,527	7433	6244	$64	$4.48	$54	996
0.20	$71,369	9911	8325	$72	$5.04	$60	1180
0.25	$89,211	12388	10406	$82	$5.74	$69	1295
0.30	$107,053	14866	12488	$89	$6.23	$75	1432
0.35	$124,895	17344	14569	$97	$6.79	$81	1533
0.40	$142,737	19822	16650	$105	$7.35	$88	1618
0.5	$178,422	24777	20813	$125	$8.75	$105	1699
1.0	$356,844	49554	41625	$206	$14.42	$173	2062
1.5	$535,265	74331	62438	$290	$20.30	$244	2197
2.0	$713,687	99108	83250	$373	$26.11	$313	2278
2.5	$892,109	123885	104063	$459	$32.13	$386	2314
3.0	$1,070,531	148662	124876	$543	$38.01	$456	2347
3.5	$1,248,952	173438	145688	$627	$43.89	$527	2371
4.0	$1,427,374	198215	166501	$711	$49.77	$597	2390
4.5	$1,605,796	222992	187314	$794	$55.58	$667	2408
5.0	$1,784,218	247769	208126	$878	$61.46	$738	2419
10.0	$3,568,435	495539	416252	$1,718	$120.26	$1,443	2473
15.0	$5,352,653	743308	624379	$2,560	$179.20	$2,150	2489
20.0	$7,136,870	991077	832505	$3,400	$238.00	$2,856	2499
25.0	$8,921,088	1238846	1040631	$4,240	$296.80	$3,562	2505
30.0	$10,705,306	1486616	1248757	$5,079	$355.53	$4,266	2509

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 7 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	10152	$82	$5.74	$69	259
0.10	$35,684	24171	20304	$119	$8.33	$100	357
0.15	$53,527	36257	30456	$160	$11.20	$134	398
0.20	$71,369	48342	40607	$203	$14.21	$171	419
0.25	$89,211	60428	50759	$244	$17.08	$205	435
0.30	$107,053	72513	60911	$284	$19.88	$239	449
0.35	$124,895	84599	71063	$325	$22.75	$273	457
0.40	$142,737	96684	81215	$366	$25.62	$307	464
0.5	$178,422	120855	101519	$449	$31.43	$377	473
1.0	$356,844	241711	203037	$858	$60.06	$721	495
1.5	$535,265	362566	304556	$1,269	$88.83	$1,066	502
2.0	$713,687	483422	406074	$1,677	$117.39	$1,409	507
2.5	$892,109	604277	507593	$2,088	$146.16	$1,754	509
3.0	$1,070,531	725133	609111	$2,496	$174.72	$2,097	511
3.5	$1,248,952	845988	710630	$2,907	$203.49	$2,442	511
4.0	$1,427,374	966843	812148	$3,318	$232.26	$2,787	512
4.5	$1,605,796	1087699	913667	$3,727	$260.89	$3,131	513
5.0	$1,784,218	1208554	1015186	$4,138	$289.66	$3,476	513
10.0	$3,568,435	2417109	2030371	$8,235	$576.45	$6,917	516
15.0	$5,352,653	3625663	3045557	$12,334	$863.38	$10,361	517
20.0	$7,136,870	4834217	4060742	$16,434	$1,150.38	$13,805	517
25.0	$8,921,088	6042771	5075928	$20,535	$1,437.45	$17,249	517
30.0	$10,705,306	7251326	6091114	$24,632	$1,724.24	$20,691	517

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 7 percent capture.

System Projections Assuming 10 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

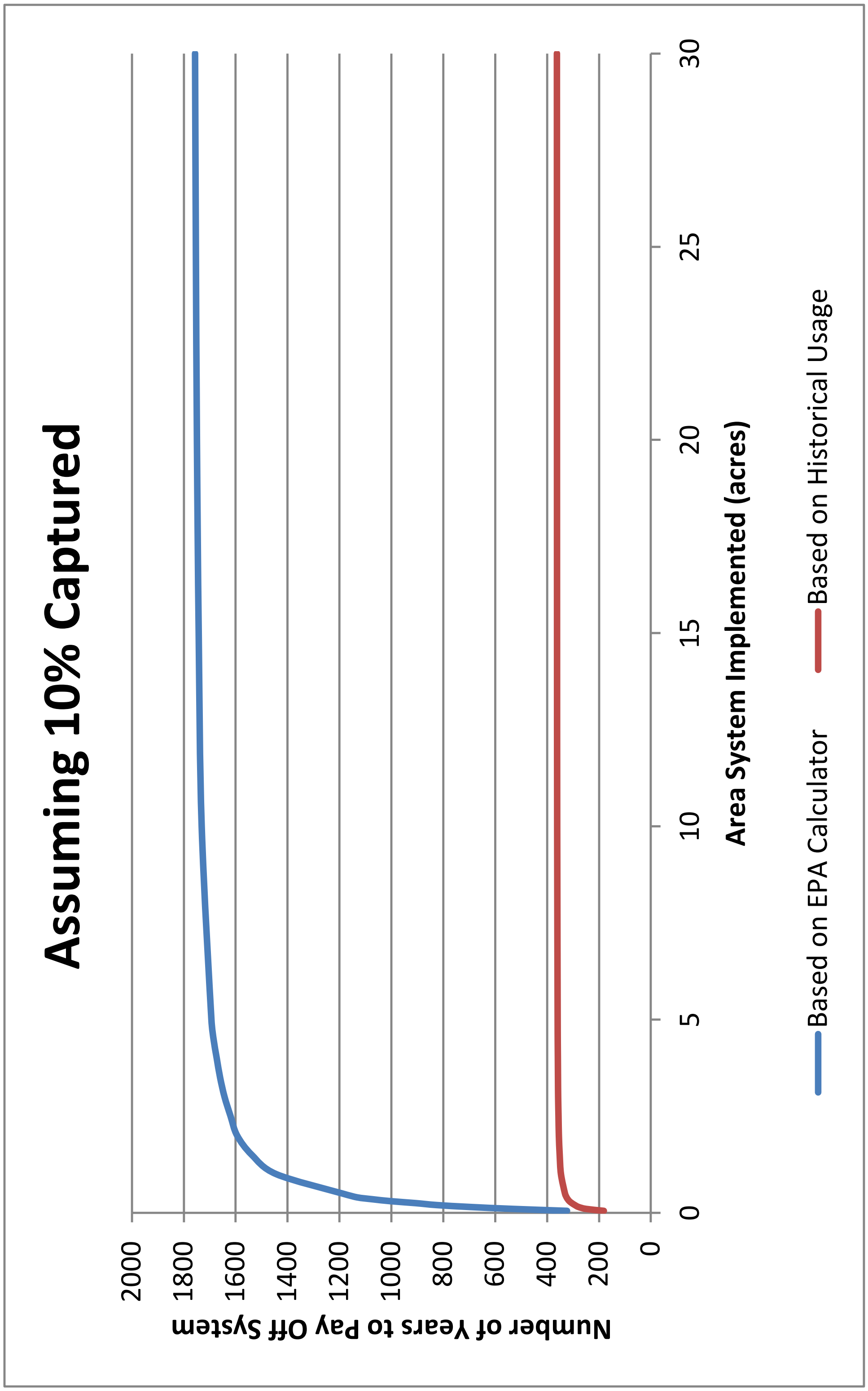
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	2973	$46	$4.60	$55	323
0.10	$35,684	4955	5946	$56	$5.60	$67	531
0.15	$53,527	7433	8920	$64	$6.40	$77	697
0.20	$71,369	9911	11893	$72	$7.20	$86	826
0.25	$89,211	12388	14866	$82	$8.20	$98	907
0.30	$107,053	14866	17839	$89	$8.90	$107	1002
0.35	$124,895	17344	20813	$97	$9.70	$116	1073
0.40	$142,737	19822	23786	$105	$10.50	$126	1133
0.5	$178,422	24777	29732	$125	$12.50	$150	1189
1.0	$356,844	49554	59465	$206	$20.60	$247	1444
1.5	$535,265	74331	89197	$290	$29.00	$348	1538
2.0	$713,687	99108	118929	$373	$37.30	$448	1594
2.5	$892,109	123885	148662	$459	$45.90	$551	1620
3.0	$1,070,531	148662	178394	$543	$54.30	$652	1643
3.5	$1,248,952	173438	208126	$627	$62.70	$752	1660
4.0	$1,427,374	198215	237859	$711	$71.10	$853	1673
4.5	$1,605,796	222992	267591	$794	$79.40	$953	1685
5.0	$1,784,218	247769	297323	$878	$87.80	$1,054	1693
10.0	$3,568,435	495539	594646	$1,718	$171.80	$2,062	1731
15.0	$5,352,653	743308	891969	$2,560	$256.00	$3,072	1742
20.0	$7,136,870	991077	1189293	$3,400	$340.00	$4,080	1749
25.0	$8,921,088	1238846	1486616	$4,240	$424.00	$5,088	1753
30.0	$10,705,306	1486616	1783939	$5,079	$507.90	$6,095	1756

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 10 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	14503	$82	$8.20	$98	181
0.10	$35,684	24171	29005	$119	$11.90	$143	250
0.15	$53,527	36257	43508	$160	$16.00	$192	279
0.20	$71,369	48342	58011	$203	$20.30	$244	293
0.25	$89,211	60428	72513	$244	$24.40	$293	305
0.30	$107,053	72513	87016	$284	$28.40	$341	314
0.35	$124,895	84599	101519	$325	$32.50	$390	320
0.40	$142,737	96684	116021	$366	$36.60	$439	325
0.5	$178,422	120855	145027	$449	$44.90	$539	331
1.0	$356,844	241711	290053	$858	$85.80	$1,030	347
1.5	$535,265	362566	435080	$1,269	$126.90	$1,523	352
2.0	$713,687	483422	580106	$1,677	$167.70	$2,012	355
2.5	$892,109	604277	725133	$2,088	$208.80	$2,506	356
3.0	$1,070,531	725133	870159	$2,496	$249.60	$2,995	357
3.5	$1,248,952	845988	1015186	$2,907	$290.70	$3,488	358
4.0	$1,427,374	966843	1160212	$3,318	$331.80	$3,982	358
4.5	$1,605,796	1087699	1305239	$3,727	$372.70	$4,472	359
5.0	$1,784,218	1208554	1450265	$4,138	$413.80	$4,966	359
10.0	$3,568,435	2417109	2900530	$8,235	$823.50	$9,882	361
15.0	$5,352,653	3625663	4350795	$12,334	$1,233.40	$14,801	362
20.0	$7,136,870	4834217	5801061	$16,434	$1,643.40	$19,721	362
25.0	$8,921,088	6042771	7251326	$20,535	$2,053.50	$24,642	362
30.0	$10,705,306	7251326	8701591	$24,632	$2,463.20	$29,558	362

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 10 percent capture.

System Projections Assuming 15 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

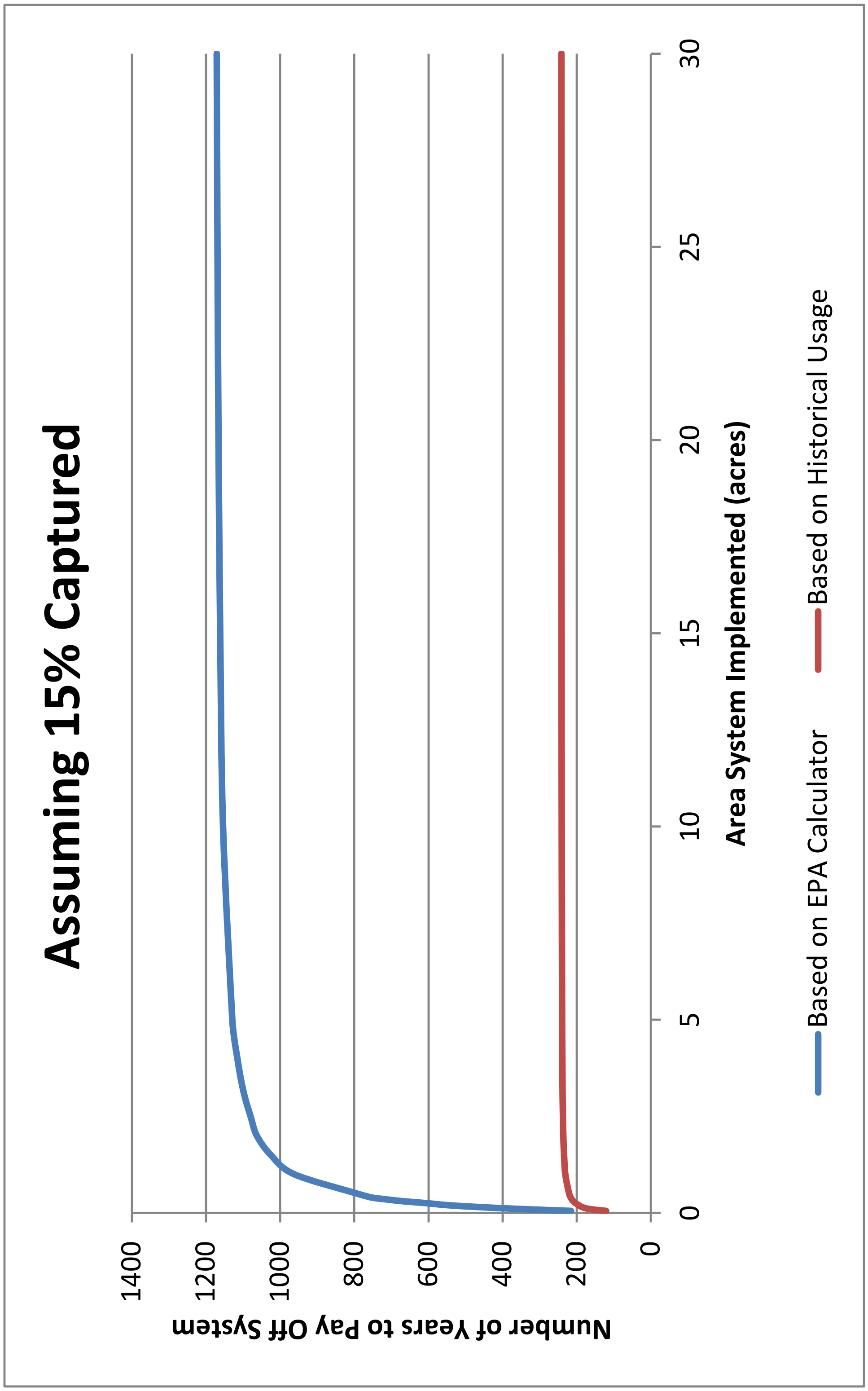
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	4460	$46	$6.90	$83	215
0.10	$35,684	4955	8920	$56	$8.40	$101	354
0.15	$53,527	7433	13380	$64	$9.60	$115	465
0.20	$71,369	9911	17839	$72	$10.80	$130	551
0.25	$89,211	12388	22299	$82	$12.30	$148	604
0.30	$107,053	14866	26759	$89	$13.35	$160	668
0.35	$124,895	17344	31219	$97	$14.55	$175	715
0.40	$142,737	19822	35679	$105	$15.75	$189	755
0.5	$178,422	24777	44598	$125	$18.75	$225	793
1.0	$356,844	49554	89197	$206	$30.90	$371	962
1.5	$535,265	74331	133795	$290	$43.50	$522	1025
2.0	$713,687	99108	178394	$373	$55.95	$671	1063
2.5	$892,109	123885	222992	$459	$68.85	$826	1080
3.0	$1,070,531	148662	267591	$543	$81.45	$977	1095
3.5	$1,248,952	173438	312189	$627	$94.05	$1,129	1107
4.0	$1,427,374	198215	356788	$711	$106.65	$1,280	1115
4.5	$1,605,796	222992	401386	$794	$119.10	$1,429	1124
5.0	$1,784,218	247769	445985	$878	$131.70	$1,580	1129
10.0	$3,568,435	495539	891969	$1,718	$257.70	$3,092	1154
15.0	$5,352,653	743308	1337954	$2,560	$384.00	$4,608	1162
20.0	$7,136,870	991077	1783939	$3,400	$510.00	$6,120	1166
25.0	$8,921,088	1238846	2229924	$4,240	$636.00	$7,632	1169
30.0	$10,705,306	1486616	2675908	$5,079	$761.85	$9,142	1171

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 15 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	21754	$82	$12.30	$148	121
0.10	$35,684	24171	43508	$119	$17.85	$214	167
0.15	$53,527	36257	65262	$160	$24.00	$288	186
0.20	$71,369	48342	87016	$203	$30.45	$365	195
0.25	$89,211	60428	108770	$244	$36.60	$439	203
0.30	$107,053	72513	130524	$284	$42.60	$511	209
0.35	$124,895	84599	152278	$325	$48.75	$585	213
0.40	$142,737	96684	174032	$366	$54.90	$659	217
0.5	$178,422	120855	217540	$449	$67.35	$808	221
1.0	$356,844	241711	435080	$858	$128.70	$1,544	231
1.5	$535,265	362566	652619	$1,269	$190.35	$2,284	234
2.0	$713,687	483422	870159	$1,677	$251.55	$3,019	236
2.5	$892,109	604277	1087699	$2,088	$313.20	$3,758	237
3.0	$1,070,531	725133	1305239	$2,496	$374.40	$4,493	238
3.5	$1,248,952	845988	1522778	$2,907	$436.05	$5,233	239
4.0	$1,427,374	966843	1740318	$3,318	$497.70	$5,972	239
4.5	$1,605,796	1087699	1957858	$3,727	$559.05	$6,709	239
5.0	$1,784,218	1208554	2175398	$4,138	$620.70	$7,448	240
10.0	$3,568,435	2417109	4350795	$8,235	$1,235.25	$14,823	241
15.0	$5,352,653	3625663	6526193	$12,334	$1,850.10	$22,201	241
20.0	$7,136,870	4834217	8701591	$16,434	$2,465.10	$29,581	241
25.0	$8,921,088	6042771	10876989	$20,535	$3,080.25	$36,963	241
30.0	$10,705,306	7251326	13052386	$24,632	$3,694.80	$44,338	241

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 15% capture.

System Projections Assuming 20 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

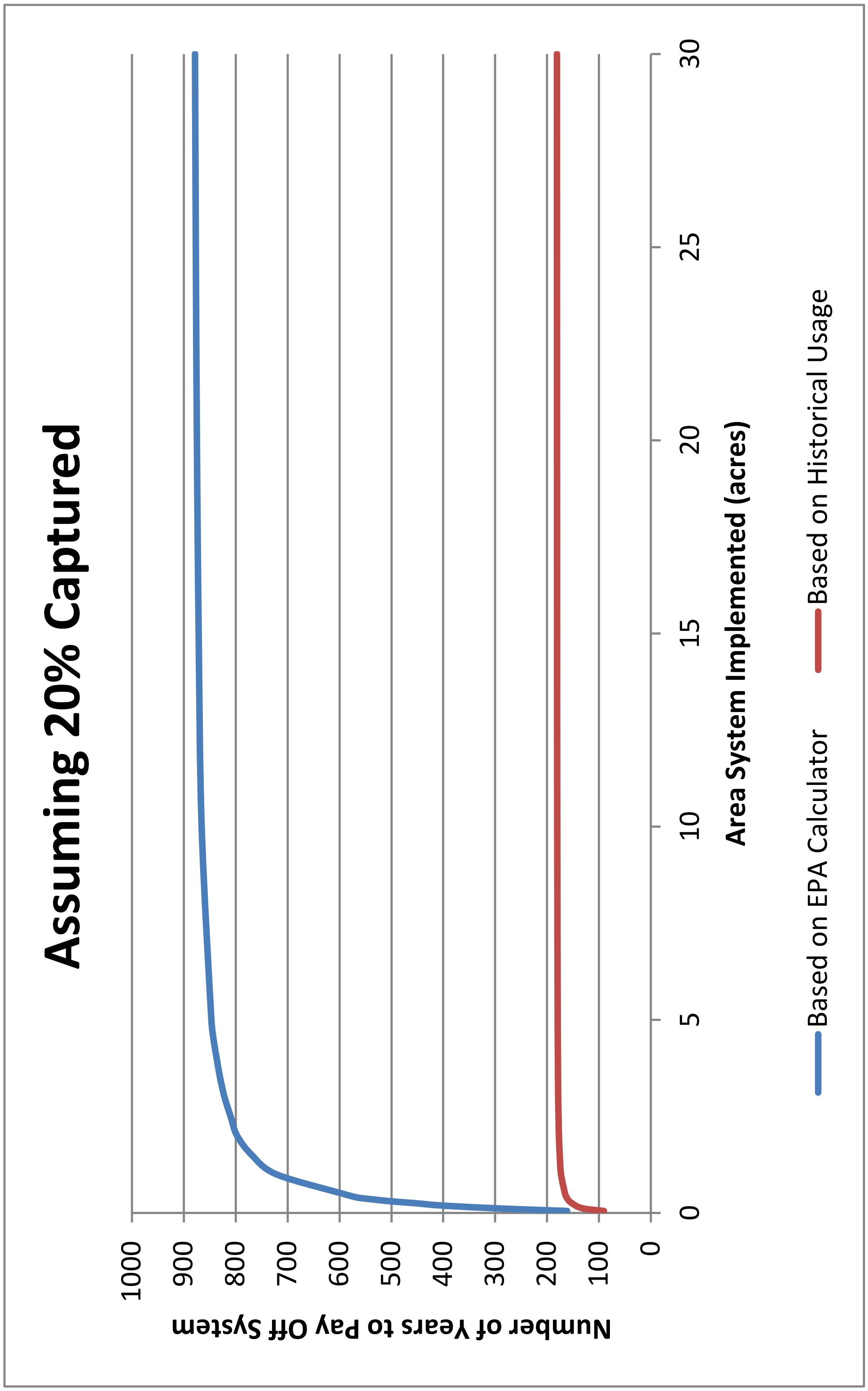
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	2973	$46	$4.60	$55	323
0.10	$35,684	4955	5946	$56	$5.60	$67	531
0.15	$53,527	7433	8920	$64	$6.40	$77	697
0.20	$71,369	9911	11893	$72	$7.20	$86	826
0.25	$89,211	12388	14866	$82	$8.20	$98	907
0.30	$107,053	14866	17839	$89	$8.90	$107	1002
0.35	$124,895	17344	20813	$97	$9.70	$116	1073
0.40	$142,737	19822	23786	$105	$10.50	$126	1133
0.5	$178,422	24777	29732	$125	$12.50	$150	1189
1.0	$356,844	49554	59465	$206	$20.60	$247	1444
1.5	$535,265	74331	89197	$290	$29.00	$348	1538
2.0	$713,687	99108	118929	$373	$37.30	$448	1594
2.5	$892,109	123885	148662	$459	$45.90	$551	1620
3.0	$1,070,531	148662	178394	$543	$54.30	$652	1643
3.5	$1,248,952	173438	208126	$627	$62.70	$752	1660
4.0	$1,427,374	198215	237859	$711	$71.10	$853	1673
4.5	$1,605,796	222992	267591	$794	$79.40	$953	1685
5.0	$1,784,218	247769	297323	$878	$87.80	$1,054	1693
10.0	$3,568,435	495539	594646	$1,718	$171.80	$2,062	1731
15.0	$5,352,653	743308	891969	$2,560	$256.00	$3,072	1742
20.0	$7,136,870	991077	1189293	$3,400	$340.00	$4,080	1749
25.0	$8,921,088	1238846	1486616	$4,240	$424.00	$5,088	1753
30.0	$10,705,306	1486616	1783939	$5,079	$507.90	$6,095	1756

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 20 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	14503	$82	$8.20	$98	181
0.10	$35,684	24171	29005	$119	$11.90	$143	250
0.15	$53,527	36257	43508	$160	$16.00	$192	279
0.20	$71,369	48342	58011	$203	$20.30	$244	293
0.25	$89,211	60428	72513	$244	$24.40	$293	305
0.30	$107,053	72513	87016	$284	$28.40	$341	314
0.35	$124,895	84599	101519	$325	$32.50	$390	320
0.40	$142,737	96684	116021	$366	$36.60	$439	325
0.5	$178,422	120855	145027	$449	$44.90	$539	331
1.0	$356,844	241711	290053	$858	$85.80	$1,030	347
1.5	$535,265	362566	435080	$1,269	$126.90	$1,523	352
2.0	$713,687	483422	580106	$1,677	$167.70	$2,012	355
2.5	$892,109	604277	725133	$2,088	$208.80	$2,506	356
3.0	$1,070,531	725133	870159	$2,496	$249.60	$2,995	357
3.5	$1,248,952	845988	1015186	$2,907	$290.70	$3,488	358
4.0	$1,427,374	966843	1160212	$3,318	$331.80	$3,982	358
4.5	$1,605,796	1087699	1305239	$3,727	$372.70	$4,472	359
5.0	$1,784,218	1208554	1450265	$4,138	$413.80	$4,966	359
10.0	$3,568,435	2417109	2900530	$8,235	$823.50	$9,882	361
15.0	$5,352,653	3625663	4350795	$12,334	$1,233.40	$14,801	362
20.0	$7,136,870	4834217	5801061	$16,434	$1,643.40	$19,721	362
25.0	$8,921,088	6042771	7251326	$20,535	$2,053.50	$24,642	362
30.0	$10,705,306	7251326	8701591	$24,632	$2,463.20	$29,558	362

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 20 percent capture.

System Projections Assuming 25 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

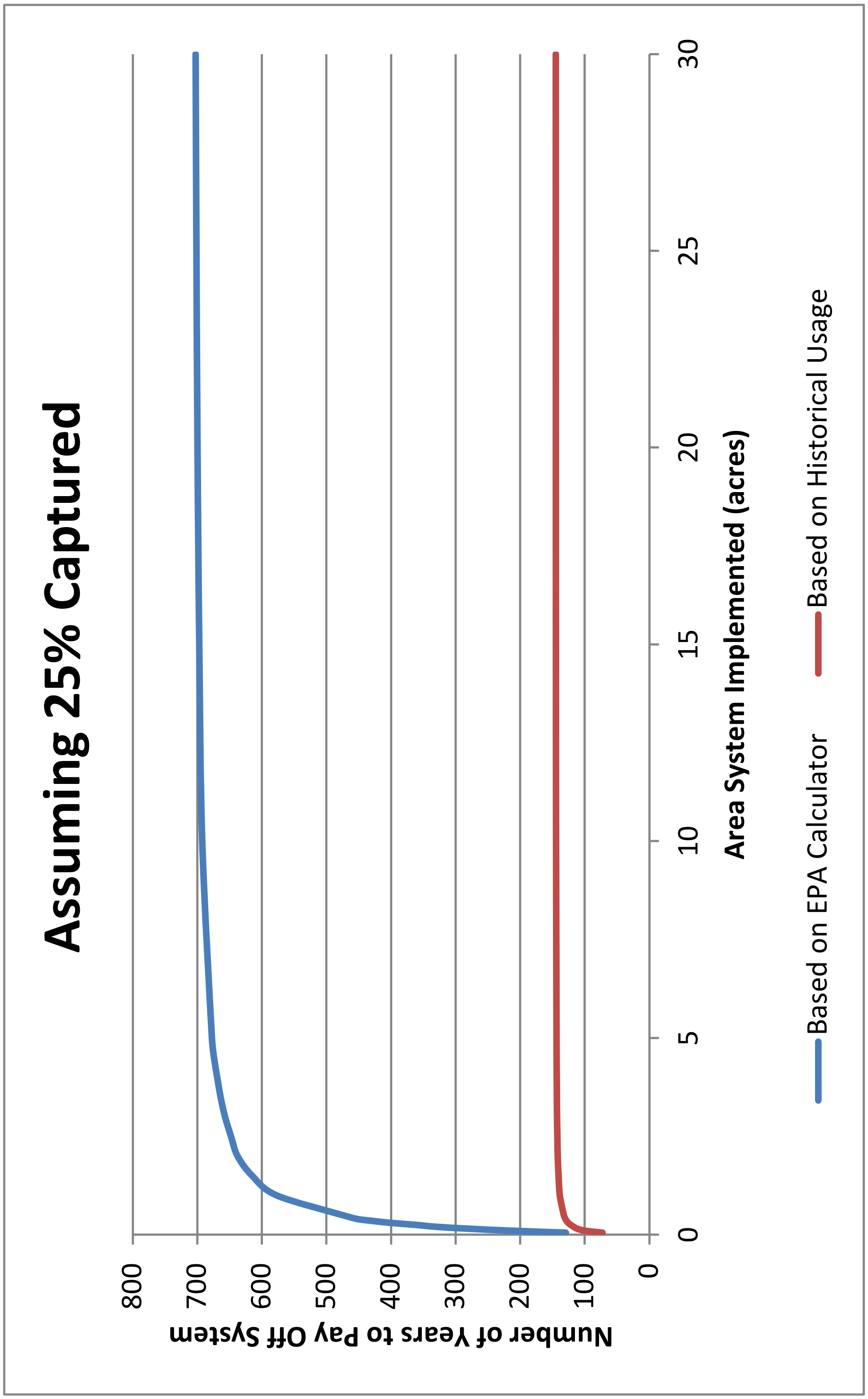
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	7433	$46	$11.50	$138	129
0.10	$35,684	4955	14866	$56	$14.00	$168	212
0.15	$53,527	7433	22299	$64	$16.00	$192	279
0.20	$71,369	9911	29732	$72	$18.00	$216	330
0.25	$89,211	12388	37165	$82	$20.50	$246	363
0.30	$107,053	14866	44598	$89	$22.25	$267	401
0.35	$124,895	17344	52032	$97	$24.25	$291	429
0.40	$142,737	19822	59465	$105	$26.25	$315	453
0.5	$178,422	24777	74331	$125	$31.25	$375	476
1.0	$356,844	49554	148662	$206	$51.50	$618	577
1.5	$535,265	74331	222992	$290	$72.50	$870	615
2.0	$713,687	99108	297323	$373	$93.25	$1,119	638
2.5	$892,109	123885	371654	$459	$114.75	$1,377	648
3.0	$1,070,531	148662	445985	$543	$135.75	$1,629	657
3.5	$1,248,952	173438	520315	$627	$156.75	$1,881	664
4.0	$1,427,374	198215	594646	$711	$177.75	$2,133	669
4.5	$1,605,796	222992	668977	$794	$198.50	$2,382	674
5.0	$1,784,218	247769	743308	$878	$219.50	$2,634	677
10.0	$3,568,435	495539	1486616	$1,718	$429.50	$5,154	692
15.0	$5,352,653	743308	2229924	$2,560	$640.00	$7,680	697
20.0	$7,136,870	991077	2973231	$3,400	$850.00	$10,200	700
25.0	$8,921,088	1238846	3716539	$4,240	$1,060.00	$12,720	701
30.0	$10,705,306	1486616	4459847	$5,079	$1,269.75	$15,237	703

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 25 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	36257	$82	$20.50	$246	73
0.10	$35,684	24171	72513	$119	$29.75	$357	100
0.15	$53,527	36257	108770	$160	$40.00	$480	112
0.20	$71,369	48342	145027	$203	$50.75	$609	117
0.25	$89,211	60428	181283	$244	$61.00	$732	122
0.30	$107,053	72513	217540	$284	$71.00	$852	126
0.35	$124,895	84599	253796	$325	$81.25	$975	128
0.40	$142,737	96684	290053	$366	$91.50	$1,098	130
0.5	$178,422	120855	362566	$449	$112.25	$1,347	132
1.0	$356,844	241711	725133	$858	$214.50	$2,574	139
1.5	$535,265	362566	1087699	$1,269	$317.25	$3,807	141
2.0	$713,687	483422	1450265	$1,677	$419.25	$5,031	142
2.5	$892,109	604277	1812831	$2,088	$522.00	$6,264	142
3.0	$1,070,531	725133	2175398	$2,496	$624.00	$7,488	143
3.5	$1,248,952	845988	2537964	$2,907	$726.75	$8,721	143
4.0	$1,427,374	966843	2900530	$3,318	$829.50	$9,954	143
4.5	$1,605,796	1087699	3263097	$3,727	$931.75	$11,181	144
5.0	$1,784,218	1208554	3625663	$4,138	$1,034.50	$12,414	144
10.0	$3,568,435	2417109	7251326	$8,235	$2,058.75	$24,705	144
15.0	$5,352,653	3625663	10876989	$12,334	$3,083.50	$37,002	145
20.0	$7,136,870	4834217	14502651	$16,434	$4,108.50	$49,302	145
25.0	$8,921,088	6042771	18128314	$20,535	$5,133.75	$61,605	145
30.0	$10,705,306	7251326	21753977	$24,632	$6,158.00	$73,896	145

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 25 percent capture.

System Projections Assuming 30 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

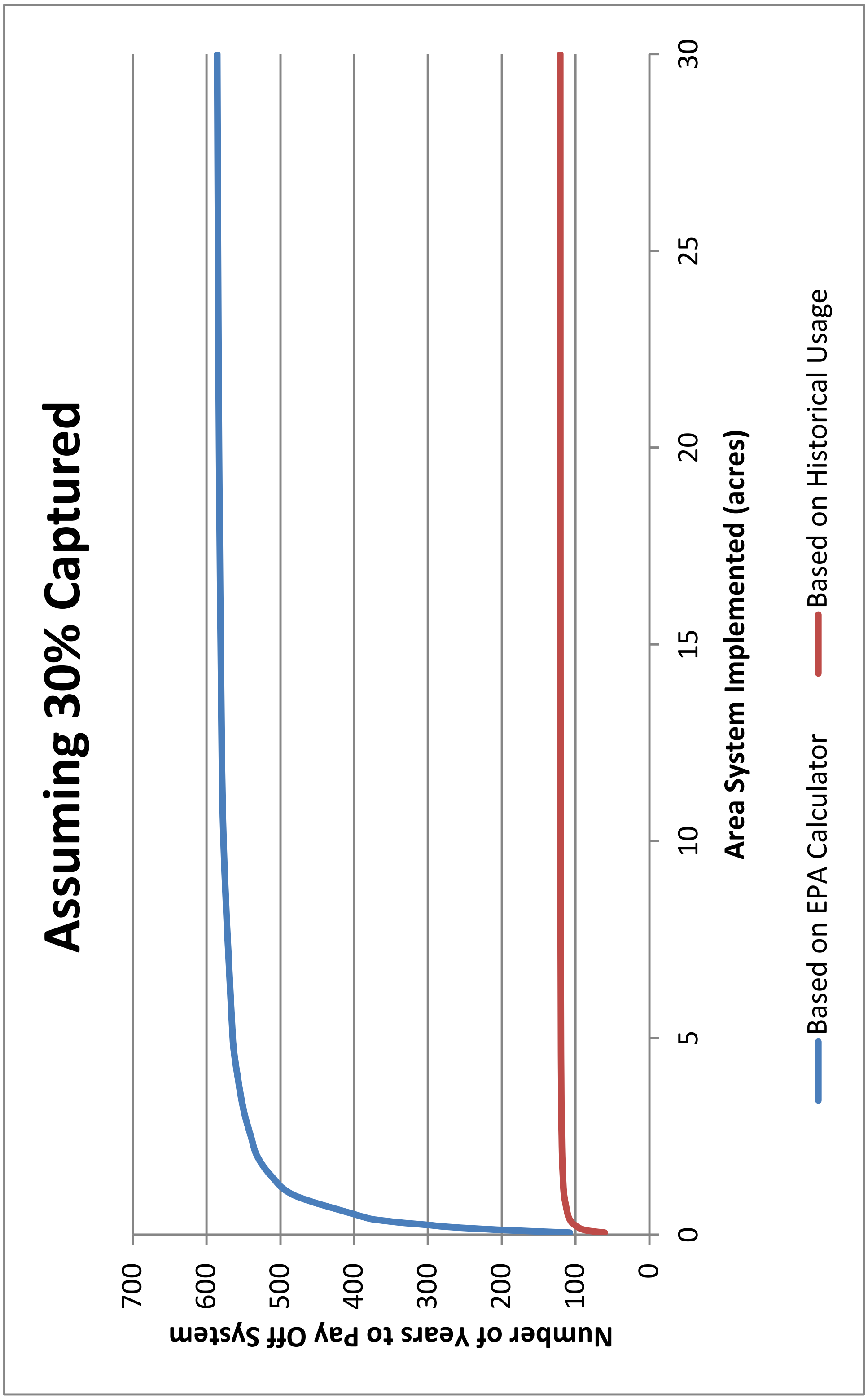
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	8920	$46	$13.80	$166	108
0.10	$35,684	4955	17839	$56	$16.80	$202	177
0.15	$53,527	7433	26759	$64	$19.20	$230	232
0.20	$71,369	9911	35679	$72	$21.60	$259	275
0.25	$89,211	12388	44598	$82	$24.60	$295	302
0.30	$107,053	14866	53518	$89	$26.70	$320	334
0.35	$124,895	17344	62438	$97	$29.10	$349	358
0.40	$142,737	19822	71358	$105	$31.50	$378	378
0.5	$178,422	24777	89197	$125	$37.50	$450	396
1.0	$356,844	49554	178394	$206	$61.80	$742	481
1.5	$535,265	74331	267591	$290	$87.00	$1,044	513
2.0	$713,687	99108	356788	$373	$111.90	$1,343	531
2.5	$892,109	123885	445985	$459	$137.70	$1,652	540
3.0	$1,070,531	148662	535182	$543	$162.90	$1,955	548
3.5	$1,248,952	173438	624379	$627	$188.10	$2,257	553
4.0	$1,427,374	198215	713576	$711	$213.30	$2,560	558
4.5	$1,605,796	222992	802772	$794	$238.20	$2,858	562
5.0	$1,784,218	247769	891969	$878	$263.40	$3,161	564
10.0	$3,568,435	495539	1783939	$1,718	$515.40	$6,185	577
15.0	$5,352,653	743308	2675908	$2,560	$768.00	$9,216	581
20.0	$7,136,870	991077	3567878	$3,400	$1,020.00	$12,240	583
25.0	$8,921,088	1238846	4459847	$4,240	$1,272.00	$15,264	584
30.0	$10,705,306	1486616	5351816	$5,079	$1,523.70	$18,284	585

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 30 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	43508	$82	$24.60	$295	60
0.10	$35,684	24171	87016	$119	$35.70	$428	83
0.15	$53,527	36257	130524	$160	$48.00	$576	93
0.20	$71,369	48342	174032	$203	$60.90	$731	98
0.25	$89,211	60428	217540	$244	$73.20	$878	102
0.30	$107,053	72513	261048	$284	$85.20	$1,022	105
0.35	$124,895	84599	304556	$325	$97.50	$1,170	107
0.40	$142,737	96684	348064	$366	$109.80	$1,318	108
0.5	$178,422	120855	435080	$449	$134.70	$1,616	110
1.0	$356,844	241711	870159	$858	$257.40	$3,089	116
1.5	$535,265	362566	1305239	$1,269	$380.70	$4,568	117
2.0	$713,687	483422	1740318	$1,677	$503.10	$6,037	118
2.5	$892,109	604277	2175398	$2,088	$626.40	$7,517	119
3.0	$1,070,531	725133	2610477	$2,496	$748.80	$8,986	119
3.5	$1,248,952	845988	3045557	$2,907	$872.10	$10,465	119
4.0	$1,427,374	966843	3480636	$3,318	$995.40	$11,945	119
4.5	$1,605,796	1087699	3915716	$3,727	$1,118.10	$13,417	120
5.0	$1,784,218	1208554	4350795	$4,138	$1,241.40	$14,897	120
10.0	$3,568,435	2417109	8701591	$8,235	$2,470.50	$29,646	120
15.0	$5,352,653	3625663	13052386	$12,334	$3,700.20	$44,402	121
20.0	$7,136,870	4834217	17403182	$16,434	$4,930.20	$59,162	121
25.0	$8,921,088	6042771	21753977	$20,535	$6,160.50	$73,926	121
30.0	$10,705,306	7251326	26104773	$24,632	$7,389.60	$88,675	121

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 30 percent capture.

System Projections Assuming 35 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

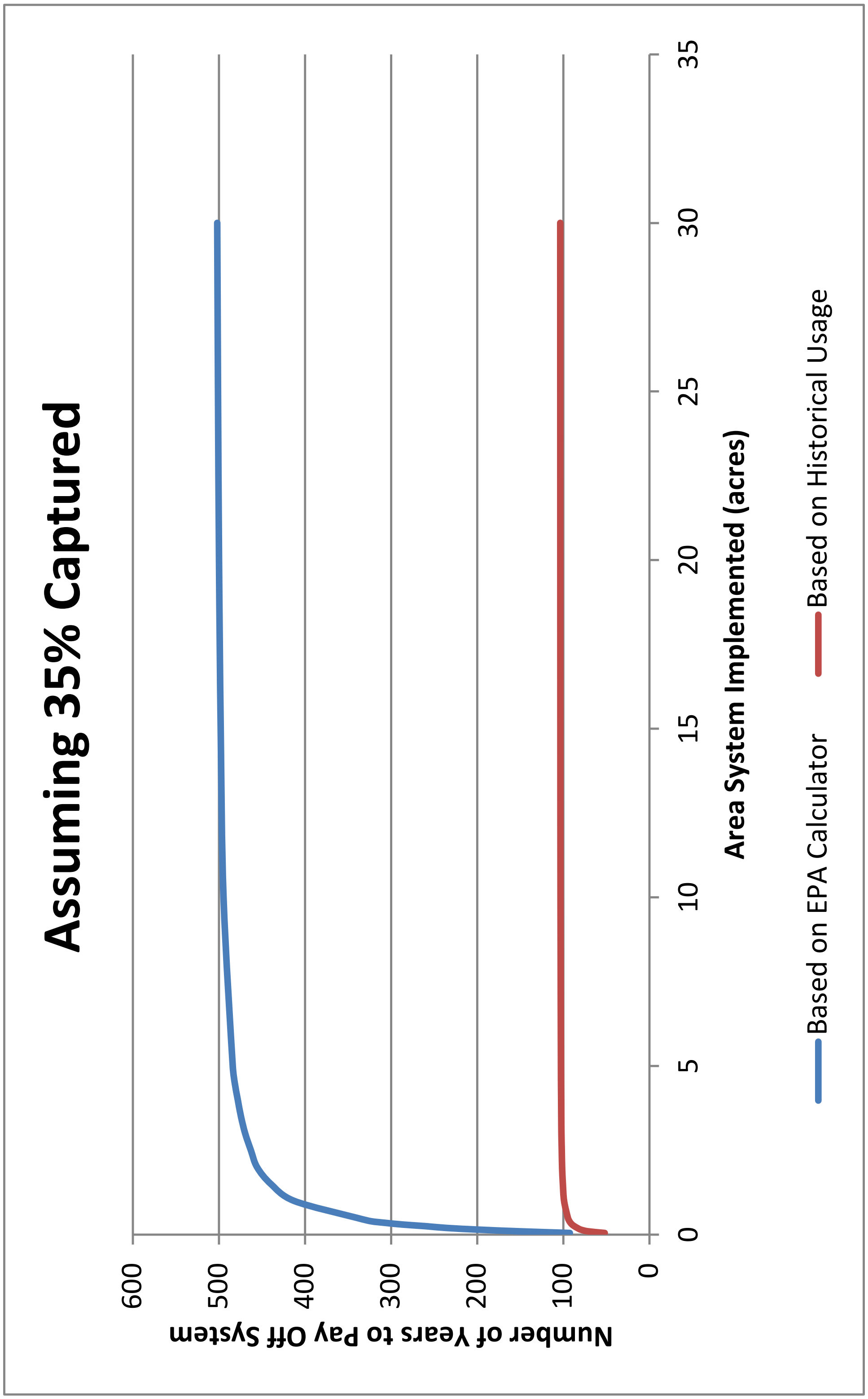
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	10406	$46	$16.10	$193	92
0.10	$35,684	4955	20813	$56	$19.60	$235	152
0.15	$53,527	7433	31219	$64	$22.40	$269	199
0.20	$71,369	9911	41625	$72	$25.20	$302	236
0.25	$89,211	12388	52032	$82	$28.70	$344	259
0.30	$107,053	14866	62438	$89	$31.15	$374	286
0.35	$124,895	17344	72844	$97	$33.95	$407	307
0.40	$142,737	19822	83250	$105	$36.75	$441	324
0.5	$178,422	24777	104063	$125	$43.75	$525	340
1.0	$356,844	49554	208126	$206	$72.10	$865	412
1.5	$535,265	74331	312189	$290	$101.50	$1,218	439
2.0	$713,687	99108	416252	$373	$130.55	$1,567	456
2.5	$892,109	123885	520315	$459	$160.65	$1,928	463
3.0	$1,070,531	148662	624379	$543	$190.05	$2,281	469
3.5	$1,248,952	173438	728442	$627	$219.45	$2,633	474
4.0	$1,427,374	198215	832505	$711	$248.85	$2,986	478
4.5	$1,605,796	222992	936568	$794	$277.90	$3,335	482
5.0	$1,784,218	247769	1040631	$878	$307.30	$3,688	484
10.0	$3,568,435	495539	2081262	$1,718	$601.30	$7,216	495
15.0	$5,352,653	743308	3121893	$2,560	$896.00	$10,752	498
20.0	$7,136,870	991077	4162524	$3,400	$1,190.00	$14,280	500
25.0	$8,921,088	1238846	5203155	$4,240	$1,484.00	$17,808	501
30.0	$10,705,306	1486616	6243786	$5,079	$1,777.65	$21,332	502

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 35 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	50759	$82	$28.70	$344	52
0.10	$35,684	24171	101519	$119	$41.65	$500	71
0.15	$53,527	36257	152278	$160	$56.00	$672	80
0.20	$71,369	48342	203037	$203	$71.05	$853	84
0.25	$89,211	60428	253796	$244	$85.40	$1,025	87
0.30	$107,053	72513	304556	$284	$99.40	$1,193	90
0.35	$124,895	84599	355315	$325	$113.75	$1,365	91
0.40	$142,737	96684	406074	$366	$128.10	$1,537	93
0.5	$178,422	120855	507593	$449	$157.15	$1,886	95
1.0	$356,844	241711	1015186	$858	$300.30	$3,604	99
1.5	$535,265	362566	1522778	$1,269	$444.15	$5,330	100
2.0	$713,687	483422	2030371	$1,677	$586.95	$7,043	101
2.5	$892,109	604277	2537964	$2,088	$730.80	$8,770	102
3.0	$1,070,531	725133	3045557	$2,496	$873.60	$10,483	102
3.5	$1,248,952	845988	3553150	$2,907	$1,017.45	$12,209	102
4.0	$1,427,374	966843	4060742	$3,318	$1,161.30	$13,936	102
4.5	$1,605,796	1087699	4568335	$3,727	$1,304.45	$15,653	103
5.0	$1,784,218	1208554	5075928	$4,138	$1,448.30	$17,380	103
10.0	$3,568,435	2417109	10151856	$8,235	$2,882.25	$34,587	103
15.0	$5,352,653	3625663	15227784	$12,334	$4,316.90	$51,803	103
20.0	$7,136,870	4834217	20303712	$16,434	$5,751.90	$69,023	103
25.0	$8,921,088	6042771	25379640	$20,535	$7,187.25	$86,247	103
30.0	$10,705,306	7251326	30455568	$24,632	$8,621.20	$103,454	103

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 35 percent capture.

System Projections Assuming 40 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

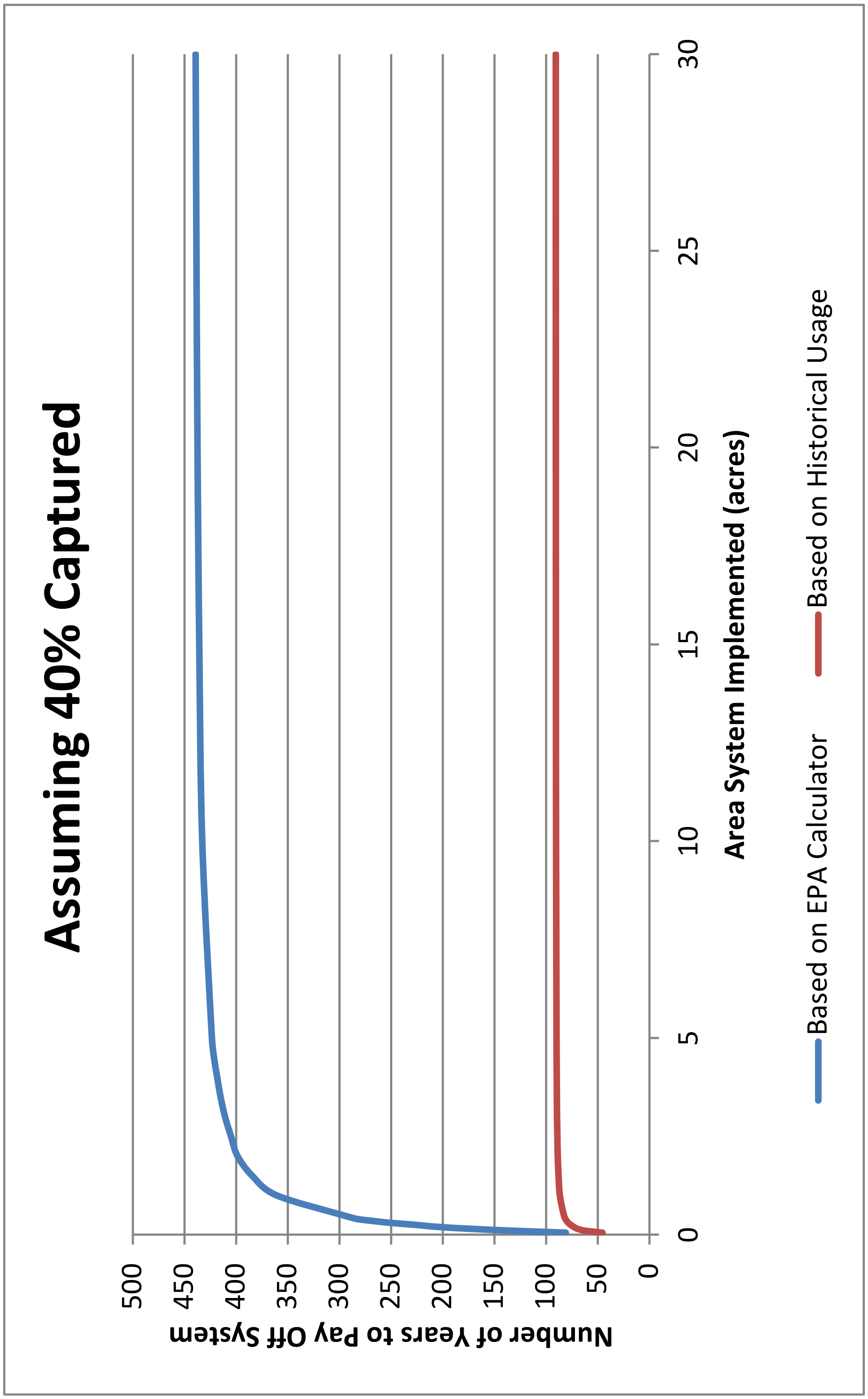
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	11893	$46	$18.40	$221	81
0.10	$35,684	4955	23786	$56	$22.40	$269	133
0.15	$53,527	7433	35679	$64	$25.60	$307	174
0.20	$71,369	9911	47572	$72	$28.80	$346	207
0.25	$89,211	12388	59465	$82	$32.80	$394	227
0.30	$107,053	14866	71358	$89	$35.60	$427	251
0.35	$124,895	17344	83250	$97	$38.80	$466	268
0.40	$142,737	19822	95143	$105	$42.00	$504	283
0.5	$178,422	24777	118929	$125	$50.00	$600	297
1.0	$356,844	49554	237859	$206	$82.40	$989	361
1.5	$535,265	74331	356788	$290	$116.00	$1,392	385
2.0	$713,687	99108	475717	$373	$149.20	$1,790	399
2.5	$892,109	123885	594646	$459	$183.60	$2,203	405
3.0	$1,070,531	148662	713576	$543	$217.20	$2,606	411
3.5	$1,248,952	173438	832505	$627	$250.80	$3,010	415
4.0	$1,427,374	198215	951434	$711	$284.40	$3,413	418
4.5	$1,605,796	222992	1070363	$794	$317.60	$3,811	421
5.0	$1,784,218	247769	1189293	$878	$351.20	$4,214	423
10.0	$3,568,435	495539	2378585	$1,718	$687.20	$8,246	433
15.0	$5,352,653	743308	3567878	$2,560	$1,024.00	$12,288	436
20.0	$7,136,870	991077	4757170	$3,400	$1,360.00	$16,320	437
25.0	$8,921,088	1238846	5946463	$4,240	$1,696.00	$20,352	438
30.0	$10,705,306	1486616	7135755	$5,079	$2,031.60	$24,379	439

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 40 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	58011	$82	$32.80	$394	45
0.10	$35,684	24171	116021	$119	$47.60	$571	62
0.15	$53,527	36257	174032	$160	$64.00	$768	70
0.20	$71,369	48342	232042	$203	$81.20	$974	73
0.25	$89,211	60428	290053	$244	$97.60	$1,171	76
0.30	$107,053	72513	348064	$284	$113.60	$1,363	79
0.35	$124,895	84599	406074	$325	$130.00	$1,560	80
0.40	$142,737	96684	464085	$366	$146.40	$1,757	81
0.5	$178,422	120855	580106	$449	$179.60	$2,155	83
1.0	$356,844	241711	1160212	$858	$343.20	$4,118	87
1.5	$535,265	362566	1740318	$1,269	$507.60	$6,091	88
2.0	$713,687	483422	2320424	$1,677	$670.80	$8,050	89
2.5	$892,109	604277	2900530	$2,088	$835.20	$10,022	89
3.0	$1,070,531	725133	3480636	$2,496	$998.40	$11,981	89
3.5	$1,248,952	845988	4060742	$2,907	$1,162.80	$13,954	90
4.0	$1,427,374	966843	4640848	$3,318	$1,327.20	$15,926	90
4.5	$1,605,796	1087699	5220955	$3,727	$1,490.80	$17,890	90
5.0	$1,784,218	1208554	5801061	$4,138	$1,655.20	$19,862	90
10.0	$3,568,435	2417109	11602121	$8,235	$3,294.00	$39,528	90
15.0	$5,352,653	3625663	17403182	$12,334	$4,933.60	$59,203	90
20.0	$7,136,870	4834217	23204242	$16,434	$6,573.60	$78,883	90
25.0	$8,921,088	6042771	29005303	$20,535	$8,214.00	$98,568	91
30.0	$10,705,306	7251326	34806363	$24,632	$9,852.80	$118,234	91

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 40 percent capture.

System Projections Assuming 45 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

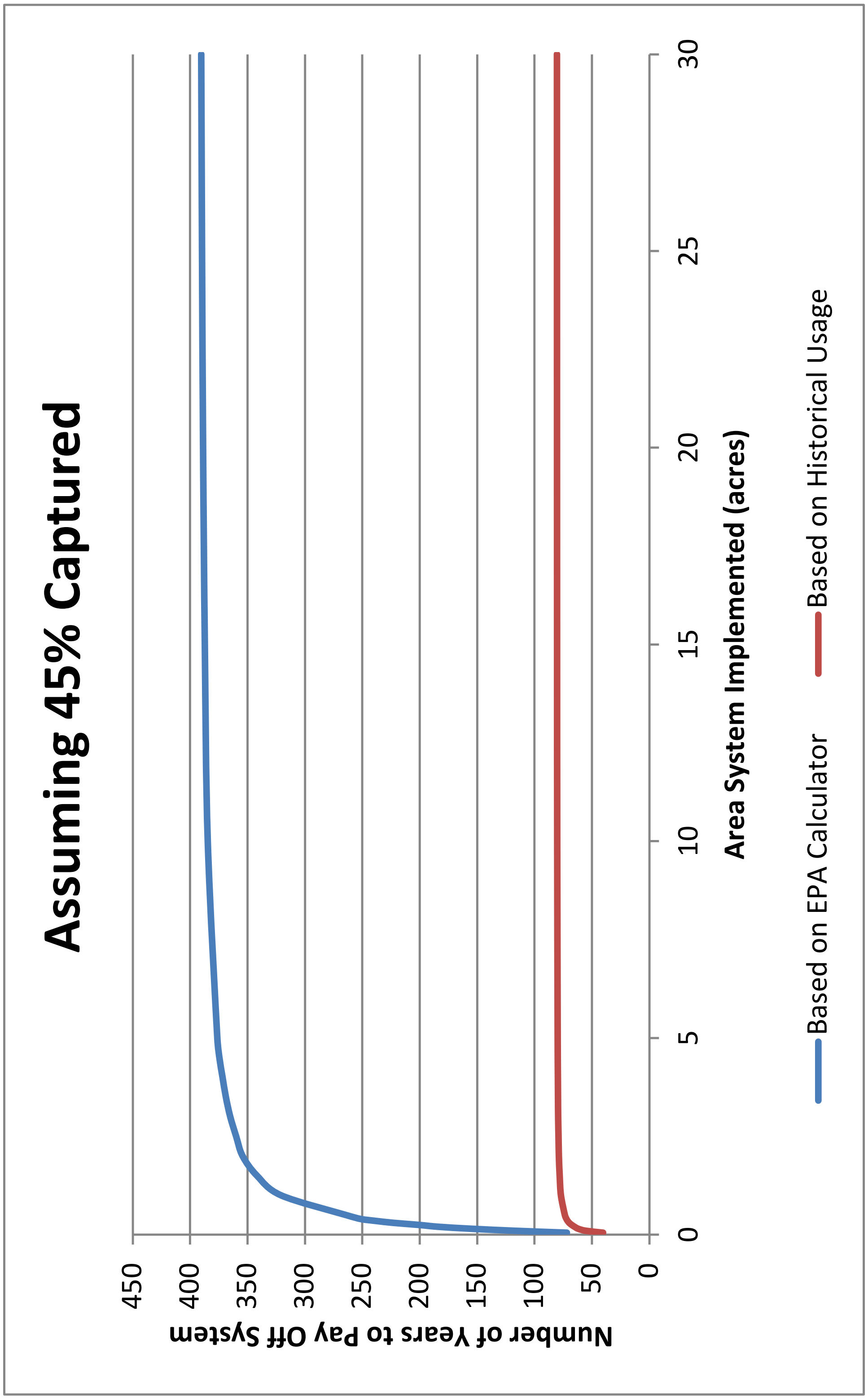
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	13380	$46	$20.70	$248	72
0.10	$35,684	4955	26759	$56	$25.20	$302	118
0.15	$53,527	7433	40139	$64	$28.80	$346	155
0.20	$71,369	9911	53518	$72	$32.40	$389	184
0.25	$89,211	12388	66898	$82	$36.90	$443	201
0.30	$107,053	14866	80277	$89	$40.05	$481	223
0.35	$124,895	17344	93657	$97	$43.65	$524	238
0.40	$142,737	19822	107036	$105	$47.25	$567	252
0.5	$178,422	24777	133795	$125	$56.25	$675	264
1.0	$356,844	49554	267591	$206	$92.70	$1,112	321
1.5	$535,265	74331	401386	$290	$130.50	$1,566	342
2.0	$713,687	99108	535182	$373	$167.85	$2,014	354
2.5	$892,109	123885	668977	$459	$206.55	$2,479	360
3.0	$1,070,531	148662	802772	$543	$244.35	$2,932	365
3.5	$1,248,952	173438	936568	$627	$282.15	$3,386	369
4.0	$1,427,374	198215	1070363	$711	$319.95	$3,839	372
4.5	$1,605,796	222992	1204159	$794	$357.30	$4,288	375
5.0	$1,784,218	247769	1337954	$878	$395.10	$4,741	376
10.0	$3,568,435	495539	2675908	$1,718	$773.10	$9,277	385
15.0	$5,352,653	743308	4013862	$2,560	$1,152.00	$13,824	387
20.0	$7,136,870	991077	5351816	$3,400	$1,530.00	$18,360	389
25.0	$8,921,088	1238846	6689771	$4,240	$1,908.00	$22,896	390
30.0	$10,705,306	1486616	8027725	$5,079	$2,285.55	$27,427	390

[1] Based on Long Beach Water Department Bill Estimator (2015).

System Projections Assuming 45 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	65262	$82	$36.90	$443	40
0.10	$35,684	24171	130524	$119	$53.55	$643	56
0.15	$53,527	36257	195786	$160	$72.00	$864	62
0.20	$71,369	48342	261048	$203	$91.35	$1,096	65
0.25	$89,211	60428	326310	$244	$109.80	$1,318	68
0.30	$107,053	72513	391572	$284	$127.80	$1,534	70
0.35	$124,895	84599	456834	$325	$146.25	$1,755	71
0.40	$142,737	96684	522095	$366	$164.70	$1,976	72
0.5	$178,422	120855	652619	$449	$202.05	$2,425	74
1.0	$356,844	241711	1305239	$858	$386.10	$4,633	77
1.5	$535,265	362566	1957858	$1,269	$571.05	$6,853	78
2.0	$713,687	483422	2610477	$1,677	$754.65	$9,056	79
2.5	$892,109	604277	3263097	$2,088	$939.60	$11,275	79
3.0	$1,070,531	725133	3915716	$2,496	$1,123.20	$13,478	79
3.5	$1,248,952	845988	4568335	$2,907	$1,308.15	$15,698	80
4.0	$1,427,374	966843	5220955	$3,318	$1,493.10	$17,917	80
4.5	$1,605,796	1087699	5873574	$3,727	$1,677.15	$20,126	80
5.0	$1,784,218	1208554	6526193	$4,138	$1,862.10	$22,345	80
10.0	$3,568,435	2417109	13052386	$8,235	$3,705.75	$44,469	80
15.0	$5,352,653	3625663	19578579	$12,334	$5,550.30	$66,604	80
20.0	$7,136,870	4834217	26104773	$16,434	$7,395.30	$88,744	80
25.0	$8,921,088	6042771	32630966	$20,535	$9,240.75	$110,889	80
30.0	$10,705,306	7251326	39157159	$24,632	$11,084.40	$133,013	80

[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 45 percent capture.

System Projections Assuming 50 Percent Capture Efficiency and EPA Water Budget Tool (2015) Irrigation Demand.

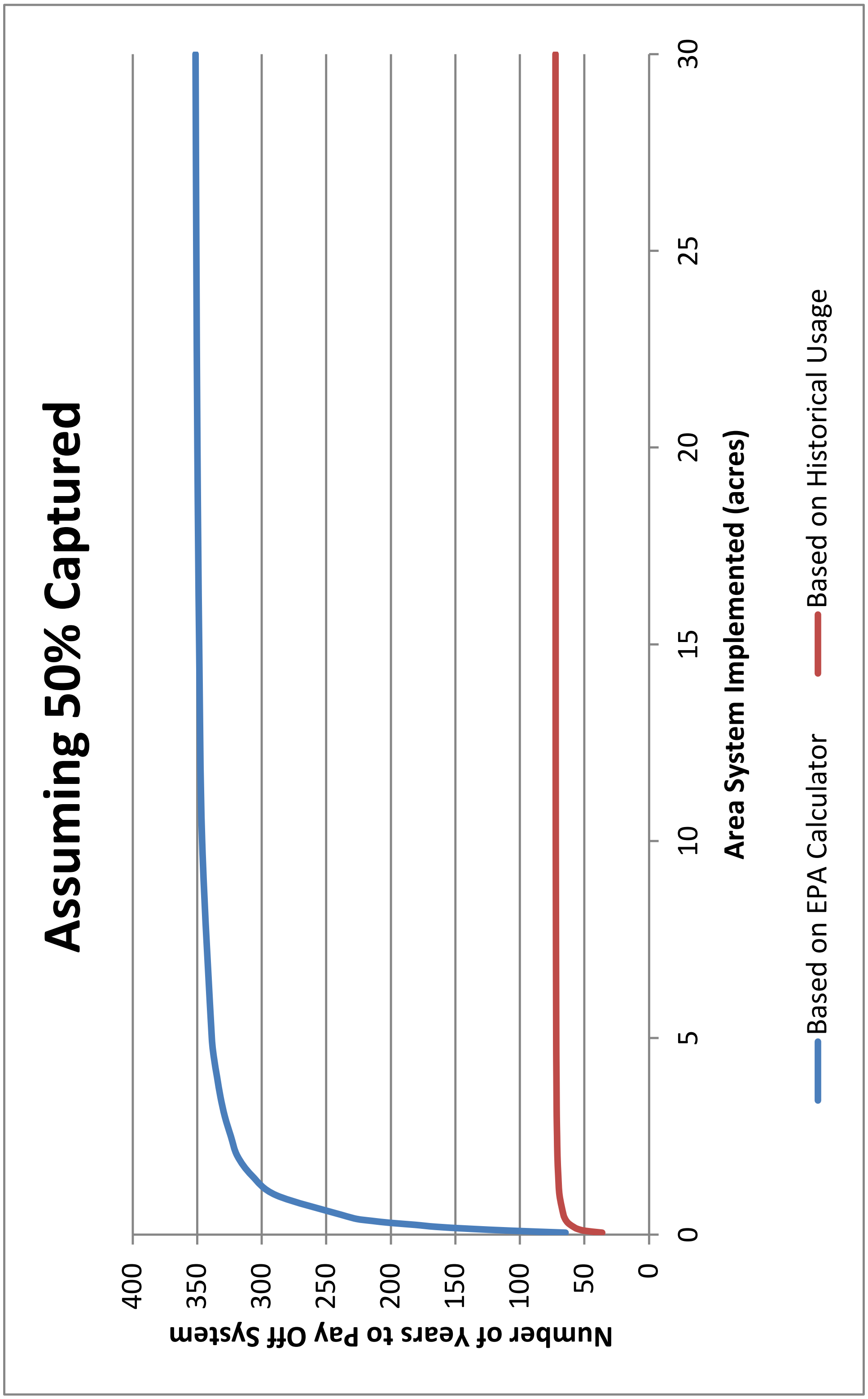
Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	2478	14866	$46	$23.00	$276	65
0.10	$35,684	4955	29732	$56	$28.00	$336	106
0.15	$53,527	7433	44598	$64	$32.00	$384	139
0.20	$71,369	9911	59465	$72	$36.00	$432	165
0.25	$89,211	12388	74331	$82	$41.00	$492	181
0.30	$107,053	14866	89197	$89	$44.50	$534	200
0.35	$124,895	17344	104063	$97	$48.50	$582	215
0.40	$142,737	19822	118929	$105	$52.50	$630	227
0.5	$178,422	24777	148662	$125	$62.50	$750	238
1.0	$356,844	49554	297323	$206	$103.00	$1,236	289
1.5	$535,265	74331	445985	$290	$145.00	$1,740	308
2.0	$713,687	99108	594646	$373	$186.50	$2,238	319
2.5	$892,109	123885	743308	$459	$229.50	$2,754	324
3.0	$1,070,531	148662	891969	$543	$271.50	$3,258	329
3.5	$1,248,952	173438	1040631	$627	$313.50	$3,762	332
4.0	$1,427,374	198215	1189293	$711	$355.50	$4,266	335
4.5	$1,605,796	222992	1337954	$794	$397.00	$4,764	337
5.0	$1,784,218	247769	1486616	$878	$439.00	$5,268	339
10.0	$3,568,435	495539	2973231	$1,718	$859.00	$10,308	346
15.0	$5,352,653	743308	4459847	$2,560	$1,280.00	$15,360	348
20.0	$7,136,870	991077	5946463	$3,400	$1,700.00	$20,400	350
25.0	$8,921,088	1238846	7433078	$4,240	$2,120.00	$25,440	351
30.0	$10,705,306	1486616	8919694	$5,079	$2,539.50	$30,474	351

[1] Based on Long Beach Water Department Bill Estimator (2015).

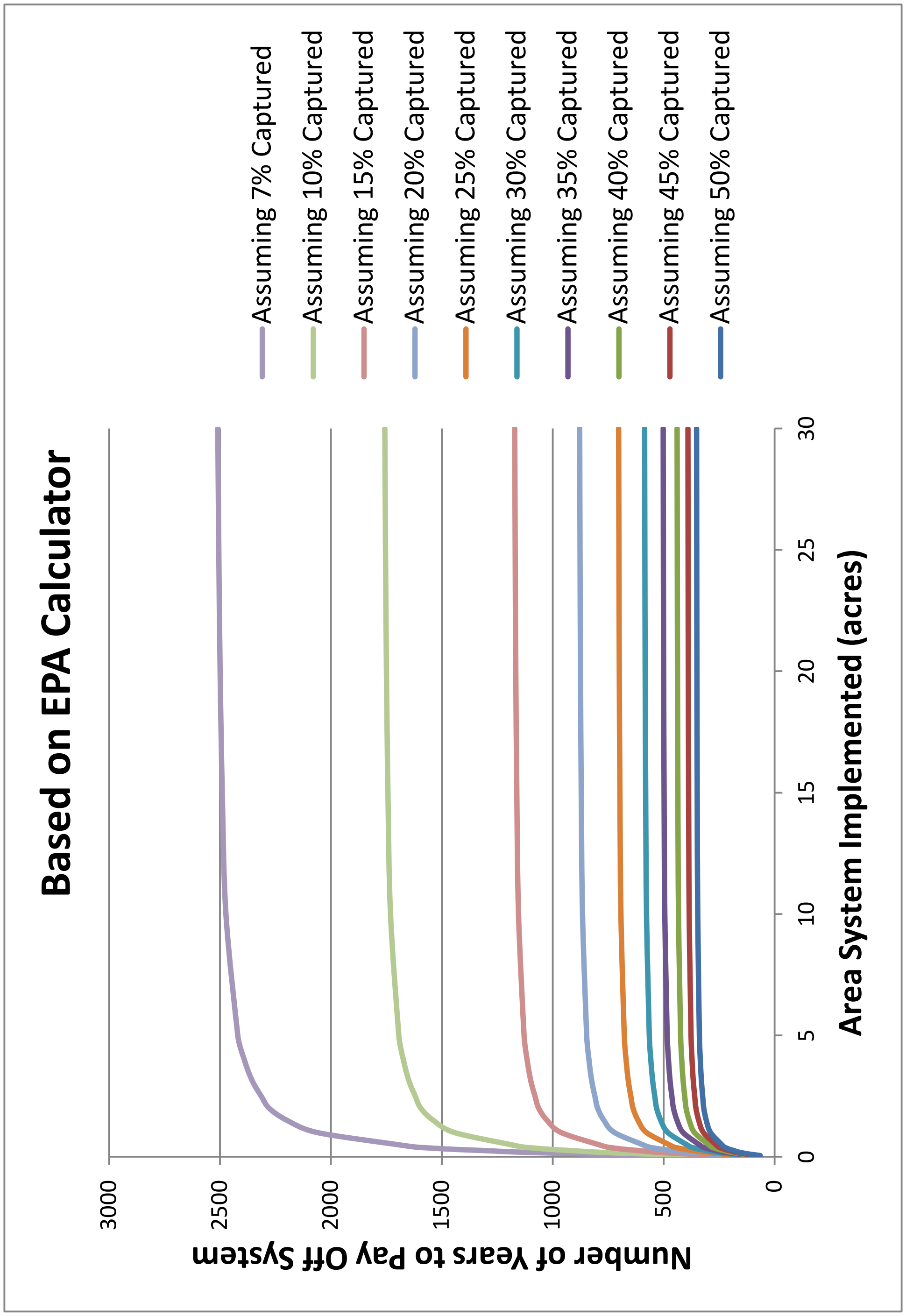
System Projections Assuming 50 Percent Capture Efficiency and Historical Manor Irrigation Demand.

Size (ac)	Cost	Monthly Use (gallons)	Annual Benefit (gallons)	Monthly Cost[1]	Monthly Savings	Annual Savings	Years to Pay Off
0.05	$17,842	12086	72513	$82	$41.00	$492	36
0.10	$35,684	24171	145027	$119	$59.50	$714	50
0.15	$53,527	36257	217540	$160	$80.00	$960	56
0.20	$71,369	48342	290053	$203	$101.50	$1,218	59
0.25	$89,211	60428	362566	$244	$122.00	$1,464	61
0.30	$107,053	72513	435080	$284	$142.00	$1,704	63
0.35	$124,895	84599	507593	$325	$162.50	$1,950	64
0.40	$142,737	96684	580106	$366	$183.00	$2,196	65
0.5	$178,422	120855	725133	$449	$224.50	$2,694	66
1.0	$356,844	241711	1450265	$858	$429.00	$5,148	69
1.5	$535,265	362566	2175398	$1,269	$634.50	$7,614	70
2.0	$713,687	483422	2900530	$1,677	$838.50	$10,062	71
2.5	$892,109	604277	3625663	$2,088	$1,044.00	$12,528	71
3.0	$1,070,531	725133	4350795	$2,496	$1,248.00	$14,976	71
3.5	$1,248,952	845988	5075928	$2,907	$1,453.50	$17,442	72
4.0	$1,427,374	966843	5801061	$3,318	$1,659.00	$19,908	72
4.5	$1,605,796	1087699	6526193	$3,727	$1,863.50	$22,362	72
5.0	$1,784,218	1208554	7251326	$4,138	$2,069.00	$24,828	72
10.0	$3,568,435	2417109	14502651	$8,235	$4,117.50	$49,410	72
15.0	$5,352,653	3625663	21753977	$12,334	$6,167.00	$74,004	72
20.0	$7,136,870	4834217	29005303	$16,434	$8,217.00	$98,604	72
25.0	$8,921,088	6042771	36256629	$20,535	$10,267.50	$123,210	72
30.0	$10,705,306	7251326	43507954	$24,632	$12,316.00	$147,792	72

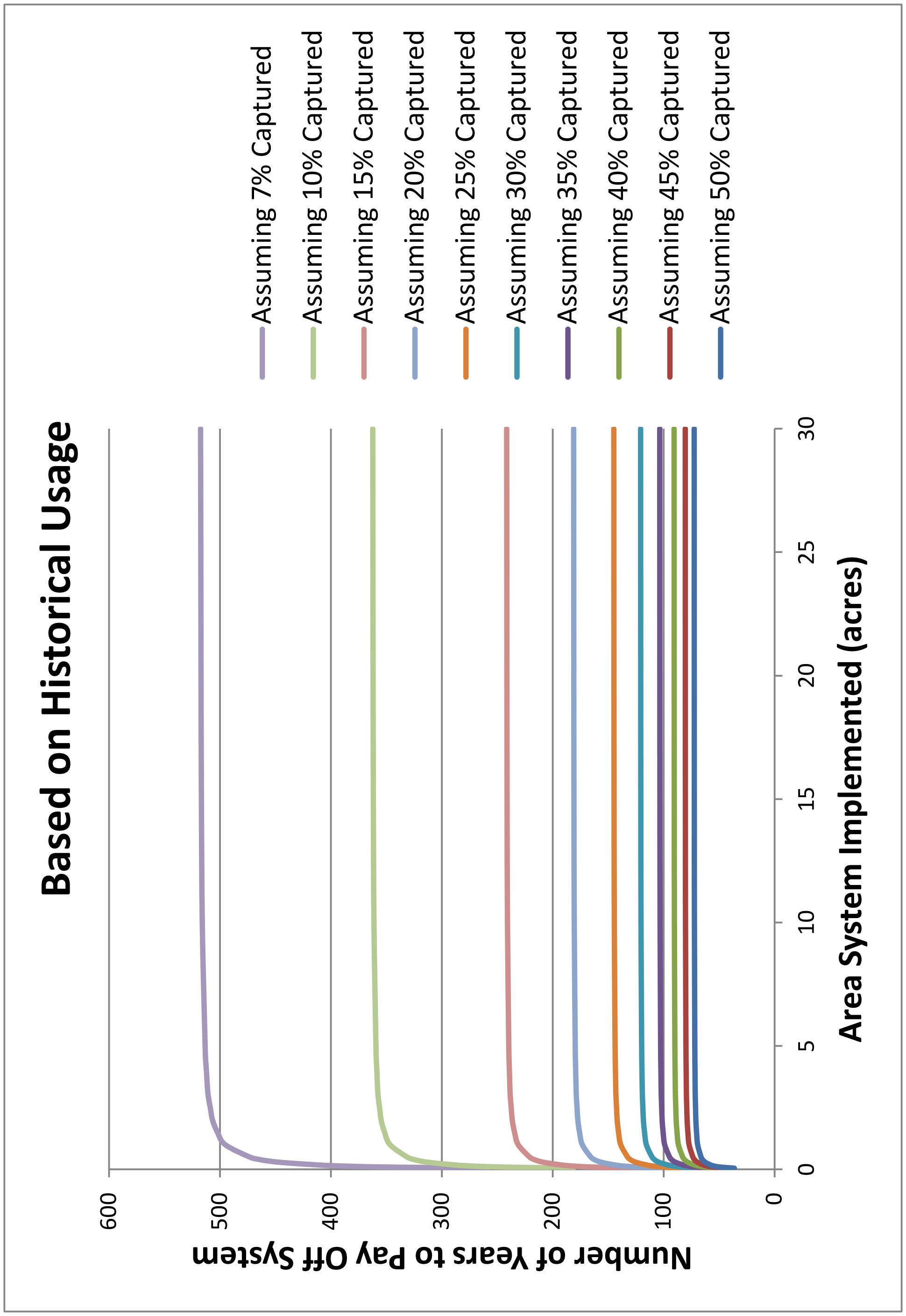
[1] Based on Long Beach Water Department Bill Estimator (2015).



Payback period assuming 50 percent capture.



Payback period assuming 50 percent capture based on the EPA water budget tool (2015) irrigation demand.



Payback period assuming 50 percent capture and the Manor historical irrigation demand.

APPENDIX E

HYDRUS 2D BASELINE FILES

ATMOSPH.IN

```
Pcp_File_Version=3
*** BLOCK K: ATMOSPHERIC INFORMATION  **********************************
   MaxAL                    (MaxAL = number of atmospheric data-records)
      2
 hCritS                 (max. allowed pressure head at the soil surface)
      0
       tAtm        Prec       rSoil       rRoot      hCritA          rt          ht          rt          ht          rt          ht          rt          ht
          1       0.075           0           0       10000           0           0           0           0           0           0           0           0
         24           0           0           0       10000           0           0           0           0           0           0           0           0
*** END OF INPUT FILE 'ATMOSPH.IN' *************************************
```

BOUNDARY.IN

```
Pcp_File_Version=3
*** BLOCK J: BOUNDARY INFORMATION *********************************************
    NumBP     NObs  SeepF  FreeD DrainF  qQWLF
       44        0      f      t      f      f
 Interp H/Flux H/Flx1  Atm/H Seep/H Atm/WL Atm/SF   Snow
      f      f      f      f      f      f      f      f
Node Number Array
      1       2       3       4       5       6       7       8       9      10
     11      12      13      14      15      16      17      18      19      20
     21      22     463     464     465     466     467     468     469     470
    471     472     473     474     475     476     477     478     479     480
    481     482     483     484
Width Array
0.0147619 0.0295238 0.0295238 0.0295237 0.0295238 0.029524 0.029524 0.0295235 0.0295235 0.029524
0.029524 0.029524 0.029524 0.0295235 0.0295235 0.029524 0.029524 0.029524 0.0295235 0.0295235
0.029524 0.014762 0.0147619 0.0295238 0.0295238 0.0295237 0.0295238 0.029524 0.029524 0.0295235
0.0295235 0.029524 0.029524 0.029524 0.029524 0.0295235 0.0295235 0.029524 0.029524 0.029524
0.0295235 0.0295235 0.029524 0.014762
Length of soil surface associated with transpiration
              0
Number of Flowing points and their indeces
    0
*** End of input file 'BOUNDARY.IN' *******************************************
```

DIMENSIO.IN

```
Pcp_File_Version=3
  NumNPD  NumElD  NumBPD  MBandD  NSeepD  NumSPD    NDrD  NElDrD   NMatD   NObsD     NSD   NAnis
     484     882      44      30       1       1       1      20       2       1       1
```

SELECTOR.IN

```
Pcp_File_Version=3
*** BLOCK A: BASIC INFORMATION *****************************************
Heading

LUnit  TUnit  MUnit  (indicated units are obligatory for all input data)
m
hours
mmol
Kat (0:horizontal plane, 1:axisymmetric vertical flow, 2:vertical plane)
  2
MaxIt   TolTh   TolH InitH/W  (max. number of iterations and tolerances)
1000    0.001   0.01     f
lWat lChem lSink Short Inter lScrn AtmIn lTemp lWTDep lEquil lExtGen lInv
 t     f     f     t     t    t     t     f     f      t      f      f
lDummy   lDummy  lDummy  lDummy  lDummy  lDummy  lDummy
 f       f       f       f       f       f       f
 PrintStep  PrintInterval lEnter
         1              1       t
*** BLOCK B: MATERIAL INFORMATION **************************************
NMat    NLay    hTab1   hTabN     NAniz
  2       1    1e-006     100
    Model   Hysteresis
      0          0
  thr    ths   Alfa     n         Ks      l
 0.045   0.41    8.5   1.95        0.3    0.5
     0    0.3     15      5          8    0.5
*** BLOCK C: TIME INFORMATION ******************************************
        dt       dtMin       dtMax     DMul     DMul2  ItMin ItMax  MPL
    0.00024    2.4e-005         120     1.3     0.7     3     7    48
      tInit        tMax
          0          24
TPrint(1),TPrint(2),...,TPrint(MPL)
        0.5           1         1.5           2         2.5           3
        3.5           4         4.5           5         5.5           6
        6.5           7         7.5           8         8.5           9
        9.5          10        10.5          11        11.5          12
       12.5          13        13.5          14        14.5          15
       15.5          16        16.5          17        17.5          18
       18.5          19        19.5          20        20.5          21
       21.5          22        22.5          23        23.5          24
*** END OF INPUT FILE 'SELECTOR.IN' ************************************
```

A_Level.out

```
All cumulative fluxes (CumQ) are positive out of the region

       Time         CumQAP        CumQRP        CumQA         CumQR        CumQ3         hAtm       hRoot      hKode3     A-
level
      [T]           [V]           [V]          [V]           [V]           [V]           [L]         [L]         [L]

        1.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00        -.1         .0          .0
1
       24.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00        -.5         .0          .0
2
End
```

Balance.out

```
 Program HYDRUS2
 Date:  15. 3.    Time:  14:29:10
 Time dependent boundary conditions
 Vertical plane flow, V = L*L
 Units: L = m    , T = hours, M = mmol


----------------------------------------------------------
 Time       [T]   .00000000E+00
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .87512E-02   .87512E-02
 InFlow   [V/T]        .00000E+00   .00000E+00
 hMean    [L]         -.35556E+02      -35.556
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]          .5000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .32029E-01   .32029E-01
 InFlow   [V/T]        .46518E-01   .46518E-01
 hMean    [L]         -.14369E+02      -14.369
 WatBalT  [V]          .27617E-04
 WatBalR  [%]                .119
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        1.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .55275E-01   .55275E-01
 InFlow   [V/T]        .46534E-01   .46534E-01
 hMean    [L]         -.44232E+01       -4.423
 WatBalT  [V]          .23592E-04
 WatBalR  [%]                .051
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        1.5000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .55277E-01   .55277E-01
 InFlow   [V/T]        .41883E-05   .41883E-05
 hMean    [L]         -.35011E+01       -3.501
 WatBalT  [V]          .25840E-04
 WatBalR  [%]                .056
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        2.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .55281E-01   .55281E-01
 InFlow   [V/T]        .12531E-04   .12531E-04
 hMean    [L]         -.23901E+01       -2.390
 WatBalT  [V]          .30164E-04
 WatBalR  [%]                .065
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        2.5000
----------------------------------------------------------
```

```
 Sub-region num.                        1
-----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .55294E-01   .55294E-01
 InFlow  [V/T]        .35018E-04   .35018E-04
 hMean   [L]         -.12996E+01       -1.300
 WatBalT [V]          .43014E-04
 WatBalR [%]                .092
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]        3.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .55313E-01   .55313E-01
 InFlow  [V/T]        .47284E-04   .47284E-04
 hMean   [L]         -.37284E+00        -.373
 WatBalT [V]          .61749E-04
 WatBalR [%]                .133
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]        3.5000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .55335E-01   .55335E-01
 InFlow  [V/T]        .18032E-04   .18032E-04
 hMean   [L]         -.15153E+00        -.152
 WatBalT [V]          .87566E-04
 WatBalR [%]                .188
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]        4.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .54076E-01   .54076E-01
 InFlow  [V/T]       -.25853E-02  -.25853E-02
 hMean   [L]         -.15380E+00        -.154
 WatBalT [V]         -.47518E-04
 WatBalR [%]                .100
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]        4.5000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .52896E-01   .52896E-01
 InFlow  [V/T]       -.19933E-02  -.19933E-02
 hMean   [L]         -.15689E+00        -.157
 WatBalT [V]         -.98752E-04
 WatBalR [%]                .203
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]        5.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .52042E-01   .52042E-01
 InFlow  [V/T]       -.16543E-02  -.16543E-02
 hMean   [L]         -.15961E+00        -.160
 WatBalT [V]         -.25184E-04
 WatBalR [%]                .051
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]        5.5000
-----------------------------------------------------------
```

```
 Sub-region num.                       1
----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .51188E-01   .51188E-01
 InFlow  [V/T]       -.16650E-02  -.16650E-02
 hMean   [L]         -.16234E+00        -.162
 WatBalT [V]          .20389E-04
 WatBalR [%]                .040
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        6.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .50361E-01   .50361E-01
 InFlow  [V/T]       -.16260E-02  -.16260E-02
 hMean   [L]         -.16506E+00        -.165
 WatBalT [V]          .88629E-04
 WatBalR [%]                .172
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        6.5000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .49555E-01   .49555E-01
 InFlow  [V/T]       -.16142E-02  -.16142E-02
 hMean   [L]         -.16777E+00        -.168
 WatBalT [V]          .17565E-03
 WatBalR [%]                .335
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        7.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .48745E-01   .48745E-01
 InFlow  [V/T]       -.16333E-02  -.16333E-02
 hMean   [L]         -.17050E+00        -.170
 WatBalT [V]          .25338E-03
 WatBalR [%]                .476
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        7.5000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .47889E-01   .47889E-01
 InFlow  [V/T]       -.17114E-02  -.17114E-02
 hMean   [L]         -.17328E+00        -.173
 WatBalT [V]          .24050E-03
 WatBalR [%]                .445
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        8.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area    [V]          .62000E+00   .62000E+00
 Volume  [V]          .47098E-01   .47098E-01
 InFlow  [V/T]       -.15657E-02  -.15657E-02
 hMean   [L]         -.17598E+00        -.176
 WatBalT [V]          .28707E-03
 WatBalR [%]                .523
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        8.5000
----------------------------------------------------------
```

```
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]         .62000E+00   .62000E+00
 Volume   [V]         .46341E-01   .46341E-01
 InFlow   [V/T]      -.14780E-02  -.14780E-02
 hMean    [L]        -.17859E+00        -.179
 WatBalT  [V]         .32536E-03
 WatBalR  [%]               .584
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]        9.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]         .62000E+00   .62000E+00
 Volume   [V]         .45630E-01   .45630E-01
 InFlow   [V/T]      -.13590E-02  -.13590E-02
 hMean    [L]        -.18106E+00        -.181
 WatBalT  [V]         .33680E-03
 WatBalR  [%]               .597
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]        9.5000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]         .62000E+00   .62000E+00
 Volume   [V]         .44976E-01   .44976E-01
 InFlow   [V/T]      -.12106E-02  -.12106E-02
 hMean    [L]        -.18335E+00        -.183
 WatBalT  [V]         .29847E-03
 WatBalR  [%]               .523
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       10.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]         .62000E+00   .62000E+00
 Volume   [V]         .44381E-01   .44381E-01
 InFlow   [V/T]      -.11429E-02  -.11429E-02
 hMean    [L]        -.18543E+00        -.185
 WatBalT  [V]         .26241E-03
 WatBalR  [%]               .455
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       10.5000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]         .62000E+00   .62000E+00
 Volume   [V]         .43884E-01   .43884E-01
 InFlow   [V/T]      -.89727E-03  -.89727E-03
 hMean    [L]        -.18727E+00        -.187
 WatBalT  [V]         .22645E-03
 WatBalR  [%]               .390
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       11.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]         .62000E+00   .62000E+00
 Volume   [V]         .43441E-01   .43441E-01
 InFlow   [V/T]      -.87317E-03  -.87317E-03
 hMean    [L]        -.18884E+00        -.189
 WatBalT  [V]         .17400E-03
 WatBalR  [%]               .298
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       11.5000
----------------------------------------------------------
```

```
 Sub-region num.                          1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .43082E-01   .43082E-01
 InFlow   [V/T]        -.75721E-03  -.75721E-03
 hMean    [L]          -.19019E+00        -.190
 WatBalT  [V]           .13703E-03
 WatBalR  [%]                 .233
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       12.0000
----------------------------------------------------------
 Sub-region num.                          1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .42734E-01   .42734E-01
 InFlow   [V/T]        -.67594E-03  -.67594E-03
 hMean    [L]          -.19141E+00        -.191
 WatBalT  [V]           .63486E-04
 WatBalR  [%]                 .107
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       12.5000
----------------------------------------------------------
 Sub-region num.                          1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .42471E-01   .42471E-01
 InFlow   [V/T]        -.44760E-03  -.44760E-03
 hMean    [L]          -.19256E+00        -.193
 WatBalT  [V]           .37161E-04
 WatBalR  [%]                 .063
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       13.0000
----------------------------------------------------------
 Sub-region num.                          1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .42223E-01   .42223E-01
 InFlow   [V/T]        -.53869E-03  -.53869E-03
 hMean    [L]          -.19348E+00        -.193
 WatBalT  [V]          -.16950E-05
 WatBalR  [%]                 .003
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       13.5000
----------------------------------------------------------
 Sub-region num.                          1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .42008E-01   .42008E-01
 InFlow   [V/T]        -.29292E-03  -.29292E-03
 hMean    [L]          -.19445E+00        -.194
 WatBalT  [V]          -.34892E-04
 WatBalR  [%]                 .058
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       14.0000
----------------------------------------------------------
 Sub-region num.                          1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .41825E-01   .41825E-01
 InFlow   [V/T]        -.30886E-03  -.30886E-03
 hMean    [L]          -.19517E+00        -.195
 WatBalT  [V]          -.56798E-04
 WatBalR  [%]                 .095
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       14.5000
----------------------------------------------------------
```

```
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .41671E-01   .41671E-01
 InFlow   [V/T]        -.24423E-03  -.24423E-03
 hMean    [L]          -.19584E+00        -.196
 WatBalT  [V]          -.62699E-04
 WatBalR  [%]                 .104
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        15.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .41517E-01   .41517E-01
 InFlow   [V/T]        -.30063E-03  -.30063E-03
 hMean    [L]          -.19646E+00        -.196
 WatBalT  [V]          -.76523E-04
 WatBalR  [%]                 .127
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        15.5000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .41387E-01   .41387E-01
 InFlow   [V/T]        -.27734E-03  -.27734E-03
 hMean    [L]          -.19706E+00        -.197
 WatBalT  [V]          -.72353E-04
 WatBalR  [%]                 .120
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        16.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .41251E-01   .41251E-01
 InFlow   [V/T]        -.22556E-03  -.22556E-03
 hMean    [L]          -.19770E+00        -.198
 WatBalT  [V]          -.79543E-04
 WatBalR  [%]                 .132
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        16.5000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .41133E-01   .41133E-01
 InFlow   [V/T]        -.21687E-03  -.21687E-03
 hMean    [L]          -.19825E+00        -.198
 WatBalT  [V]          -.81009E-04
 WatBalR  [%]                 .134
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        17.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]           .62000E+00   .62000E+00
 Volume   [V]           .41019E-01   .41019E-01
 InFlow   [V/T]        -.22077E-03  -.22077E-03
 hMean    [L]          -.19880E+00        -.199
 WatBalT  [V]          -.79820E-04
 WatBalR  [%]                 .132
----------------------------------------------------------

----------------------------------------------------------
 Time       [T]        17.5000
----------------------------------------------------------
```

```
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40912E-01   .40913E-01
 InFlow   [V/T]       -.19617E-03  -.19617E-03
 hMean    [L]         -.19933E+00        -.199
 WatBalT  [V]         -.73801E-04
 WatBalR  [%]                .121
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       18.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40815E-01   .40815E-01
 InFlow   [V/T]       -.18721E-03  -.18721E-03
 hMean    [L]         -.19983E+00        -.200
 WatBalT  [V]         -.69415E-04
 WatBalR  [%]                .114
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       18.5000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40722E-01   .40722E-01
 InFlow   [V/T]       -.18693E-03  -.18693E-03
 hMean    [L]         -.20031E+00        -.200
 WatBalT  [V]         -.60962E-04
 WatBalR  [%]                .100
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       19.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40633E-01   .40633E-01
 InFlow   [V/T]       -.17792E-03  -.17792E-03
 hMean    [L]         -.20079E+00        -.201
 WatBalT  [V]         -.48572E-04
 WatBalR  [%]                .080
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       19.5000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40544E-01   .40544E-01
 InFlow   [V/T]       -.17758E-03  -.17758E-03
 hMean    [L]         -.20126E+00        -.201
 WatBalT  [V]         -.36109E-04
 WatBalR  [%]                .059
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       20.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40456E-01   .40456E-01
 InFlow   [V/T]       -.17600E-03  -.17600E-03
 hMean    [L]         -.20174E+00        -.202
 WatBalT  [V]         -.22723E-04
 WatBalR  [%]                .037
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       20.5000
-----------------------------------------------------------
```

```
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40367E-01   .40367E-01
 InFlow   [V/T]       -.17856E-03  -.17856E-03
 hMean    [L]         -.20221E+00        -.202
 WatBalT  [V]         -.10656E-04
 WatBalR  [%]                .017
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       21.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40278E-01   .40278E-01
 InFlow   [V/T]       -.17886E-03  -.17886E-03
 hMean    [L]         -.20270E+00        -.203
 WatBalT  [V]          .13656E-05
 WatBalR  [%]                .002
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       21.5000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40188E-01   .40188E-01
 InFlow   [V/T]       -.17977E-03  -.17977E-03
 hMean    [L]         -.20318E+00        -.203
 WatBalT  [V]          .12932E-04
 WatBalR  [%]                .021
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       22.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40098E-01   .40098E-01
 InFlow   [V/T]       -.18034E-03  -.18034E-03
 hMean    [L]         -.20367E+00        -.204
 WatBalT  [V]          .24285E-04
 WatBalR  [%]                .039
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       22.5000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .40007E-01   .40007E-01
 InFlow   [V/T]       -.18108E-03  -.18108E-03
 hMean    [L]         -.20417E+00        -.204
 WatBalT  [V]          .35281E-04
 WatBalR  [%]                .057
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       23.0000
-----------------------------------------------------------
 Sub-region num.                        1
-----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .39916E-01   .39916E-01
 InFlow   [V/T]       -.18159E-03  -.18159E-03
 hMean    [L]         -.20467E+00        -.205
 WatBalT  [V]          .46062E-04
 WatBalR  [%]                .074
-----------------------------------------------------------

-----------------------------------------------------------
 Time       [T]       23.5000
-----------------------------------------------------------
```

```
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .39827E-01   .39827E-01
 InFlow   [V/T]       -.17770E-03  -.17770E-03
 hMean    [L]         -.20520E+00        -.205
 WatBalT  [V]          .58787E-04
 WatBalR  [%]                .095
----------------------------------------------------------

----------------------------------------------------------
 Time        [T]       24.0000
----------------------------------------------------------
 Sub-region num.                       1
----------------------------------------------------------
 Area     [V]          .62000E+00   .62000E+00
 Volume   [V]          .39738E-01   .39738E-01
 InFlow   [V/T]       -.17818E-03  -.17818E-03
 hMean    [L]         -.20571E+00        -.206
 WatBalT  [V]          .71274E-04
 WatBalR  [%]                .115
----------------------------------------------------------

 Calculation time [sec]      48.559999987483030
```

Boundary.out

```
 Program HYDRUS2
 Date:  15. 3.    Time:  14:29:10
 Time dependent boundary conditions
 Vertical plane flow, V = L*L
 Units: L = m    , T = hours, M = mmol


 Boundary length [L] associated with different types of boundary conditions

 Atmospheric boundary:              .6199999E+00
 Free or deep drainage boundary:    .6199999E+00


 Time:             .5000

    i      n      x        z     Code       Q            v           h        th       Temp   Conc(1-NS)
Qc(1-NS)
                 [L]      [L]             [V/T]        [L/T]        [L]      [-]       [C]     [M/L3]
[VM/T.L3]

    1      1     .0      1.0    -4   .11071E-02  -.75000E-01      -.07    .362     20.00
    2      2     .0      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
    3      3     .1      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
    4      4     .1      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
    5      5     .1      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
    6      6     .1      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
    7      7     .2      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
    8      8     .2      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
    9      9     .2      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   10     10     .3      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   11     11     .3      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   12     12     .3      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   13     13     .4      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   14     14     .4      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   15     15     .4      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   16     16     .4      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   17     17     .5      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   18     18     .5      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   19     19     .5      1.0    -4   .22143E-02  -.75000E-01      -.07    .361     20.00
   20     20     .6      1.0    -4   .22143E-02  -.75000E-01      -.07    .360     20.00
   21     21     .6      1.0    -4   .22143E-02  -.75000E-01      -.07    .360     20.00
   22     22     .6      1.0    -4   .11072E-02  -.75000E-01      -.07    .359     20.00
   23    463     .0       .0    -6  -.12730E-24   .86235E-23     -6.67    .000     20.00
   24    464     .0       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   25    465     .1       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   26    466     .1       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   27    467     .1       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   28    468     .1       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   29    469     .2       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   30    470     .2       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   31    471     .2       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   32    472     .3       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   33    473     .3       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   34    474     .3       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   35    475     .4       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   36    476     .4       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   37    477     .4       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   38    478     .4       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   39    479     .5       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   40    480     .5       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   41    481     .5       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   42    482     .6       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   43    483     .6       .0    -6  -.25460E-24   .86235E-23     -6.67    .000     20.00
   44    484     .6       .0    -6  -.12730E-24   .86235E-23     -6.67    .000     20.00


 Time:            1.0000

    i      n      x        z     Code       Q            v           h        th       Temp   Conc(1-NS)
Qc(1-NS)
                 [L]      [L]             [V/T]        [L/T]        [L]      [-]       [C]     [M/L3]
[VM/T.L3]
```

```
     1      1       .0       1.0    -4    .11071E-02   -.75000E-01        -.06    .367      20.00
     2      2       .0       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
     3      3       .1       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
     4      4       .1       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
     5      5       .1       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
     6      6       .1       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
     7      7       .2       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
     8      8       .2       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
     9      9       .2       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    10     10       .3       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    11     11       .3       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    12     12       .3       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    13     13       .4       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    14     14       .4       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    15     15       .4       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    16     16       .4       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    17     17       .5       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    18     18       .5       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    19     19       .5       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    20     20       .6       1.0    -4    .22143E-02   -.75000E-01        -.06    .367      20.00
    21     21       .6       1.0    -4    .22143E-02   -.75000E-01        -.06    .366      20.00
    22     22       .6       1.0    -4    .11072E-02   -.75000E-01        -.06    .366      20.00
    23    463       .0        .0    -6   -.12730E-24    .86235E-23       -6.67    .000      20.00
    24    464       .0        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    25    465       .1        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    26    466       .1        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    27    467       .1        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    28    468       .1        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    29    469       .2        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    30    470       .2        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    31    471       .2        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    32    472       .3        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    33    473       .3        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    34    474       .3        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    35    475       .4        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    36    476       .4        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    37    477       .4        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    38    478       .4        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    39    479       .5        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    40    480       .5        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    41    481       .5        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    42    482       .6        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    43    483       .6        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
    44    484       .6        .0    -6   -.12730E-24    .86235E-23       -6.67    .000      20.00


   Time:             1.5000

      i        n        x          z     Code         Q               v              h         th        Temp    Conc(1-NS)
  Qc(1-NS)
                       [L]        [L]               [V/T]           [L/T]           [L]        [-]         [C]     [M/L3]
  [VM/T.L3]

     1      1       .0       1.0    -4    .00000E+00    .00000E+00        -.20    .237      20.00
     2      2       .0       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
     3      3       .1       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
     4      4       .1       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
     5      5       .1       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
     6      6       .1       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
     7      7       .2       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
     8      8       .2       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
     9      9       .2       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    10     10       .3       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    11     11       .3       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    12     12       .3       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    13     13       .4       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    14     14       .4       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    15     15       .4       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    16     16       .4       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    17     17       .5       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    18     18       .5       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    19     19       .5       1.0    -4    .00000E+00    .00000E+00        -.20    .236      20.00
    20     20       .6       1.0    -4    .00000E+00    .00000E+00        -.20    .235      20.00
    21     21       .6       1.0    -4    .00000E+00    .00000E+00        -.20    .235      20.00
    22     22       .6       1.0    -4    .00000E+00    .00000E+00        -.20    .235      20.00
    23    463       .0        .0    -6   -.12730E-24    .86235E-23       -6.67    .000      20.00
    24    464       .0        .0    -6   -.25460E-24    .86235E-23       -6.67    .000      20.00
```

```
    25     465       .1       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    26     466       .1       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    27     467       .1       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    28     468       .1       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    29     469       .2       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    30     470       .2       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    31     471       .2       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    32     472       .3       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    33     473       .3       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    34     474       .3       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    35     475       .4       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    36     476       .4       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    37     477       .4       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    38     478       .4       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    39     479       .5       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    40     480       .5       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    41     481       .5       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    42     482       .6       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    43     483       .6       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    44     484       .6       .0   -6  -.12730E-24   .86235E-23      -6.67   .000     20.00


  Time:          2.0000

     i      n        x         z   Code       Q            v            h       th       Temp   Conc(1-NS)
 Qc(1-NS)
                    [L]       [L]           [V/T]        [L/T]         [L]      [-]       [C]     [M/L3]

 [VM/T.L3]

     1       1       .0      1.0   -4   .00000E+00   .00000E+00       -.24   .213     20.00
     2       2       .0      1.0   -4   .00000E+00   .00000E+00       -.24   .213     20.00
     3       3       .1      1.0   -4   .00000E+00   .00000E+00       -.24   .213     20.00
     4       4       .1      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
     5       5       .1      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
     6       6       .1      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
     7       7       .2      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
     8       8       .2      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
     9       9       .2      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    10      10       .3      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    11      11       .3      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    12      12       .3      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    13      13       .4      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    14      14       .4      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    15      15       .4      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    16      16       .4      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    17      17       .5      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    18      18       .5      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    19      19       .5      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    20      20       .6      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    21      21       .6      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    22      22       .6      1.0   -4   .00000E+00   .00000E+00       -.24   .212     20.00
    23     463       .0       .0   -6  -.12730E-24   .86235E-23      -6.67   .000     20.00
    24     464       .0       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    25     465       .1       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    26     466       .1       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    27     467       .1       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    28     468       .1       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    29     469       .2       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    30     470       .2       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    31     471       .2       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    32     472       .3       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    33     473       .3       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    34     474       .3       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    35     475       .4       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    36     476       .4       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    37     477       .4       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    38     478       .4       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    39     479       .5       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    40     480       .5       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    41     481       .5       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    42     482       .6       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    43     483       .6       .0   -6  -.25460E-24   .86235E-23      -6.67   .000     20.00
    44     484       .6       .0   -6  -.12730E-24   .86235E-23      -6.67   .000     20.00


  Time:          2.5000
```

```
     i      n       x        z     Code       Q            v           h       th      Temp   Conc(1-NS)
Qc(1-NS)
                   [L]      [L]              [V/T]        [L/T]         [L]     [-]      [C]    [M/L3]

[VM/T.L3]

     1      1      .0      1.0    -4   .00000E+00   .00000E+00     -.26   .200     20.00
     2      2      .0      1.0    -4   .00000E+00   .00000E+00     -.26   .200     20.00
     3      3      .1      1.0    -4   .00000E+00   .00000E+00     -.26   .200     20.00
     4      4      .1      1.0    -4   .00000E+00   .00000E+00     -.26   .200     20.00
     5      5      .1      1.0    -4   .00000E+00   .00000E+00     -.26   .200     20.00
     6      6      .1      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
     7      7      .2      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
     8      8      .2      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
     9      9      .2      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
    10     10      .3      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
    11     11      .3      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
    12     12      .3      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
    13     13      .4      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
    14     14      .4      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
    15     15      .4      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
    16     16      .4      1.0    -4   .00000E+00   .00000E+00     -.26   .199     20.00
    17     17      .5      1.0    -4   .00000E+00   .00000E+00     -.27   .199     20.00
    18     18      .5      1.0    -4   .00000E+00   .00000E+00     -.27   .199     20.00
    19     19      .5      1.0    -4   .00000E+00   .00000E+00     -.27   .199     20.00
    20     20      .6      1.0    -4   .00000E+00   .00000E+00     -.27   .199     20.00
    21     21      .6      1.0    -4   .00000E+00   .00000E+00     -.27   .199     20.00
    22     22      .6      1.0    -4   .00000E+00   .00000E+00     -.27   .199     20.00
    23    463      .0       .0    -6  -.12730E-24   .86235E-23    -6.67   .000     20.00
    24    464      .0       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    25    465      .1       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    26    466      .1       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    27    467      .1       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    28    468      .1       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    29    469      .2       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    30    470      .2       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    31    471      .2       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    32    472      .3       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    33    473      .3       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    34    474      .3       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    35    475      .4       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    36    476      .4       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    37    477      .4       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    38    478      .4       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    39    479      .5       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    40    480      .5       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    41    481      .5       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    42    482      .6       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    43    483      .6       .0    -6  -.25460E-24   .86235E-23    -6.67   .000     20.00
    44    484      .6       .0    -6  -.12730E-24   .86235E-23    -6.67   .000     20.00


 Time:             3.0000

     i      n       x        z     Code       Q            v           h       th      Temp   Conc(1-NS)
Qc(1-NS)
                   [L]      [L]              [V/T]        [L/T]         [L]     [-]      [C]    [M/L3]

[VM/T.L3]

     1      1      .0      1.0    -4   .00000E+00   .00000E+00     -.28   .192     20.00
     2      2      .0      1.0    -4   .00000E+00   .00000E+00     -.28   .191     20.00
     3      3      .1      1.0    -4   .00000E+00   .00000E+00     -.28   .191     20.00
     4      4      .1      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
     5      5      .1      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
     6      6      .1      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
     7      7      .2      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
     8      8      .2      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
     9      9      .2      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    10     10      .3      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    11     11      .3      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    12     12      .3      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    13     13      .4      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    14     14      .4      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    15     15      .4      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    16     16      .4      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    17     17      .5      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    18     18      .5      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    19     19      .5      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
    20     20      .6      1.0    -4   .00000E+00   .00000E+00     -.29   .191     20.00
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   21     21       .6      1.0   -4   .00000E+00   .00000E+00        -.29   .191      20.00
   22     22       .6      1.0   -4   .00000E+00   .00000E+00        -.29   .191      20.00
   23    463       .0       .0   -6  -.12730E-24   .86235E-23       -6.67   .000      20.00
   24    464       .0       .0   -6  -.25460E-24   .86235E-23       -6.67   .000      20.00
   25    465       .1       .0   -6  -.25460E-24   .86235E-23       -6.67   .000      20.00
   26    466       .1       .0   -6  -.25460E-24   .86235E-23       -6.67   .000      20.00
   27    467       .1       .0   -6  -.25460E-24   .86235E-23       -6.67   .000      20.00
   28    468       .1       .0   -6  -.25460E-24   .86235E-23       -6.67   .000      20.00
   29    469       .2       .0   -6  -.25460E-24   .86235E-23       -6.67   .000      20.00
   30    470       .2       .0   -6  -.25460E-24   .86235E-23       -6.67   .000      20.00
   31    471       .2       .0   -6  -.25460E-24   .86236E-23       -6.67   .000      20.00
   32    472       .3       .0   -6  -.25460E-24   .86236E-23       -6.67   .000      20.00
   33    473       .3       .0   -6  -.25461E-24   .86237E-23       -6.67   .000      20.00
   34    474       .3       .0   -6  -.25461E-24   .86237E-23       -6.67   .000      20.00
   35    475       .4       .0   -6  -.25461E-24   .86238E-23       -6.67   .000      20.00
   36    476       .4       .0   -6  -.25461E-24   .86239E-23       -6.67   .000      20.00
   37    477       .4       .0   -6  -.25462E-24   .86242E-23       -6.67   .000      20.00
   38    478       .4       .0   -6  -.25463E-24   .86244E-23       -6.67   .000      20.00
   39    479       .5       .0   -6  -.25463E-24   .86246E-23       -6.67   .000      20.00
   40    480       .5       .0   -6  -.25464E-24   .86248E-23       -6.67   .000      20.00
   41    481       .5       .0   -6  -.25465E-24   .86252E-23       -6.67   .000      20.00
   42    482       .6       .0   -6  -.25466E-24   .86257E-23       -6.67   .000      20.00
   43    483       .6       .0   -6  -.25469E-24   .86267E-23       -6.66   .000      20.00
   44    484       .6       .0   -6  -.12744E-24   .86332E-23       -6.65   .000      20.00


 Time:             3.5000

    i       n        x         z    Code       Q             v             h        th       Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]             [V/T]         [L/T]          [L]      [-]       [C]     [M/L3]

[VM/T.L3]

    1      1       .0      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
    2      2       .0      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
    3      3       .1      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
    4      4       .1      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
    5      5       .1      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
    6      6       .1      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
    7      7       .2      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
    8      8       .2      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
    9      9       .2      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   10     10       .3      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   11     11       .3      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   12     12       .3      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   13     13       .4      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   14     14       .4      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   15     15       .4      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   16     16       .4      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   17     17       .5      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   18     18       .5      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   19     19       .5      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   20     20       .6      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   21     21       .6      1.0   -4   .00000E+00   .00000E+00        -.30   .185      20.00
   22     22       .6      1.0   -4   .00000E+00   .00000E+00        -.30   .184      20.00
   23    463       .0       .0   -6  -.53326E-06   .36124E-04        -.18   .006      20.00
   24    464       .0       .0   -6  -.16649E-05   .56390E-04        -.18   .006      20.00
   25    465       .1       .0   -6  -.21654E-05   .73344E-04        -.18   .007      20.00
   26    466       .1       .0   -6  -.24890E-05   .84307E-04        -.17   .007      20.00
   27    467       .1       .0   -6  -.27966E-05   .94724E-04        -.17   .007      20.00
   28    468       .1       .0   -6  -.31192E-05   .10565E-03        -.17   .007      20.00
   29    469       .2       .0   -6  -.33915E-05   .11487E-03        -.17   .007      20.00
   30    470       .2       .0   -6  -.36001E-05   .12194E-03        -.17   .008      20.00
   31    471       .2       .0   -6  -.37488E-05   .12698E-03        -.17   .008      20.00
   32    472       .3       .0   -6  -.38565E-05   .13062E-03        -.17   .008      20.00
   33    473       .3       .0   -6  -.39448E-05   .13361E-03        -.17   .008      20.00
   34    474       .3       .0   -6  -.40271E-05   .13640E-03        -.17   .008      20.00
   35    475       .4       .0   -6  -.41081E-05   .13915E-03        -.17   .008      20.00
   36    476       .4       .0   -6  -.42077E-05   .14252E-03        -.17   .008      20.00
   37    477       .4       .0   -6  -.43382E-05   .14694E-03        -.17   .008      20.00
   38    478       .4       .0   -6  -.44976E-05   .15234E-03        -.17   .008      20.00
   39    479       .5       .0   -6  -.46756E-05   .15837E-03        -.17   .008      20.00
   40    480       .5       .0   -6  -.48684E-05   .16490E-03        -.17   .008      20.00
   41    481       .5       .0   -6  -.50986E-05   .17270E-03        -.17   .009      20.00
   42    482       .6       .0   -6  -.53468E-05   .18110E-03        -.16   .009      20.00
   43    483       .6       .0   -6  -.56104E-05   .19003E-03        -.16   .009      20.00
   44    484       .6       .0   -6  -.29477E-05   .19968E-03        -.16   .009      20.00
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```
 Time:           4.0000

    i      n       x        z    Code      Q            v            h       th      Temp   Conc(1-NS)
Qc(1-NS)
                  [L]      [L]           [V/T]        [L/T]         [L]     [-]      [C]     [M/L3]
[VM/T.L3]

    1      1      .0      1.0   -4   .00000E+00   .00000E+00      -.31   .180     20.00
    2      2      .0      1.0   -4   .00000E+00   .00000E+00      -.31   .180     20.00
    3      3      .1      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
    4      4      .1      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
    5      5      .1      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
    6      6      .1      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
    7      7      .2      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
    8      8      .2      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
    9      9      .2      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   10     10      .3      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   11     11      .3      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   12     12      .3      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   13     13      .4      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   14     14      .4      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   15     15      .4      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   16     16      .4      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   17     17      .5      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   18     18      .5      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   19     19      .5      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   20     20      .6      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   21     21      .6      1.0   -4   .00000E+00   .00000E+00      -.31   .179     20.00
   22     22      .6      1.0   -4   .00000E+00   .00000E+00      -.32   .179     20.00
   23    463      .0       .0   -6  -.60457E-04   .40954E-02      -.12   .026     20.00
   24    464      .0       .0   -6  -.12044E-03   .40793E-02      -.12   .026     20.00
   25    465      .1       .0   -6  -.12173E-03   .41233E-02      -.12   .026     20.00
   26    466      .1       .0   -6  -.12246E-03   .41479E-02      -.12   .026     20.00
   27    467      .1       .0   -6  -.12287E-03   .41616E-02      -.12   .026     20.00
   28    468      .1       .0   -6  -.12318E-03   .41722E-02      -.12   .026     20.00
   29    469      .2       .0   -6  -.12341E-03   .41801E-02      -.12   .026     20.00
   30    470      .2       .0   -6  -.12358E-03   .41859E-02      -.12   .026     20.00
   31    471      .2       .0   -6  -.12373E-03   .41908E-02      -.12   .026     20.00
   32    472      .3       .0   -6  -.12386E-03   .41953E-02      -.12   .026     20.00
   33    473      .3       .0   -6  -.12399E-03   .41996E-02      -.12   .026     20.00
   34    474      .3       .0   -6  -.12409E-03   .42031E-02      -.12   .026     20.00
   35    475      .4       .0   -6  -.12415E-03   .42049E-02      -.12   .026     20.00
   36    476      .4       .0   -6  -.12410E-03   .42036E-02      -.12   .026     20.00
   37    477      .4       .0   -6  -.12396E-03   .41987E-02      -.12   .026     20.00
   38    478      .4       .0   -6  -.12376E-03   .41917E-02      -.12   .026     20.00
   39    479      .5       .0   -6  -.12357E-03   .41854E-02      -.12   .026     20.00
   40    480      .5       .0   -6  -.12355E-03   .41849E-02      -.12   .026     20.00
   41    481      .5       .0   -6  -.12387E-03   .41956E-02      -.12   .026     20.00
   42    482      .6       .0   -6  -.12455E-03   .42187E-02      -.12   .026     20.00
   43    483      .6       .0   -6  -.12533E-03   .42452E-02      -.12   .026     20.00
   44    484      .6       .0   -6  -.62655E-04   .42444E-02      -.12   .026     20.00


 Time:           4.5000

    i      n       x        z    Code      Q            v            h       th      Temp   Conc(1-NS)
Qc(1-NS)
                  [L]      [L]           [V/T]        [L/T]         [L]     [-]      [C]     [M/L3]
[VM/T.L3]

    1      1      .0      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
    2      2      .0      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
    3      3      .1      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
    4      4      .1      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
    5      5      .1      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
    6      6      .1      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
    7      7      .2      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
    8      8      .2      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
    9      9      .2      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
   10     10      .3      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
   11     11      .3      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
   12     12      .3      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
   13     13      .4      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
   14     14      .4      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
   15     15      .4      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
   16     16      .4      1.0   -4   .00000E+00   .00000E+00      -.33   .176     20.00
   17     17      .5      1.0   -4   .00000E+00   .00000E+00      -.33   .175     20.00
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    18     18       .5      1.0   -4   .00000E+00   .00000E+00        -.33   .175      20.00
    19     19       .5      1.0   -4   .00000E+00   .00000E+00        -.33   .175      20.00
    20     20       .6      1.0   -4   .00000E+00   .00000E+00        -.33   .175      20.00
    21     21       .6      1.0   -4   .00000E+00   .00000E+00        -.33   .175      20.00
    22     22       .6      1.0   -4   .00000E+00   .00000E+00        -.33   .175      20.00
    23    463       .0       .0   -6  -.47091E-04   .31900E-02        -.12   .025      20.00
    24    464       .0       .0   -6  -.93381E-04   .31629E-02        -.12   .025      20.00
    25    465       .1       .0   -6  -.92178E-04   .31222E-02        -.12   .025      20.00
    26    466       .1       .0   -6  -.91624E-04   .31034E-02        -.12   .025      20.00
    27    467       .1       .0   -6  -.91522E-04   .31000E-02        -.12   .025      20.00
    28    468       .1       .0   -6  -.91592E-04   .31023E-02        -.12   .025      20.00
    29    469       .2       .0   -6  -.91639E-04   .31039E-02        -.12   .025      20.00
    30    470       .2       .0   -6  -.91615E-04   .31031E-02        -.12   .025      20.00
    31    471       .2       .0   -6  -.91441E-04   .30972E-02        -.12   .025      20.00
    32    472       .3       .0   -6  -.91364E-04   .30946E-02        -.12   .025      20.00
    33    473       .3       .0   -6  -.91366E-04   .30946E-02        -.12   .025      20.00
    34    474       .3       .0   -6  -.91321E-04   .30931E-02        -.12   .025      20.00
    35    475       .4       .0   -6  -.91278E-04   .30916E-02        -.12   .025      20.00
    36    476       .4       .0   -6  -.91074E-04   .30848E-02        -.12   .025      20.00
    37    477       .4       .0   -6  -.90686E-04   .30716E-02        -.12   .025      20.00
    38    478       .4       .0   -6  -.90347E-04   .30601E-02        -.12   .025      20.00
    39    479       .5       .0   -6  -.90260E-04   .30572E-02        -.12   .025      20.00
    40    480       .5       .0   -6  -.90307E-04   .30588E-02        -.12   .025      20.00
    41    481       .5       .0   -6  -.90372E-04   .30610E-02        -.12   .025      20.00
    42    482       .6       .0   -6  -.90428E-04   .30629E-02        -.12   .025      20.00
    43    483       .6       .0   -6  -.90444E-04   .30634E-02        -.12   .025      20.00
    44    484       .6       .0   -6  -.45359E-04   .30727E-02        -.12   .025      20.00


  Time:            5.0000

     i       n       x         z    Code        Q              v            h         th        Temp   Conc(1-NS)
 Qc(1-NS)
                    [L]       [L]            [V/T]          [L/T]          [L]       [-]        [C]     [M/L3]
 [VM/T.L3]

     1      1       .0      1.0   -4   .00000E+00   .00000E+00        -.34   .173      20.00
     2      2       .0      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
     3      3       .1      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
     4      4       .1      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
     5      5       .1      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
     6      6       .1      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
     7      7       .2      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
     8      8       .2      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
     9      9       .2      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    10     10       .3      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    11     11       .3      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    12     12       .3      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    13     13       .4      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    14     14       .4      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    15     15       .4      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    16     16       .4      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    17     17       .5      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    18     18       .5      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    19     19       .5      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    20     20       .6      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    21     21       .6      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    22     22       .6      1.0   -4   .00000E+00   .00000E+00        -.34   .172      20.00
    23    463       .0       .0   -6  -.42756E-04   .28963E-02        -.12   .025      20.00
    24    464       .0       .0   -6  -.85525E-04   .28968E-02        -.12   .025      20.00
    25    465       .1       .0   -6  -.85497E-04   .28959E-02        -.12   .025      20.00
    26    466       .1       .0   -6  -.85452E-04   .28943E-02        -.12   .025      20.00
    27    467       .1       .0   -6  -.85422E-04   .28933E-02        -.12   .025      20.00
    28    468       .1       .0   -6  -.85407E-04   .28928E-02        -.12   .025      20.00
    29    469       .2       .0   -6  -.85402E-04   .28926E-02        -.12   .025      20.00
    30    470       .2       .0   -6  -.85393E-04   .28924E-02        -.12   .025      20.00
    31    471       .2       .0   -6  -.85399E-04   .28926E-02        -.12   .025      20.00
    32    472       .3       .0   -6  -.85417E-04   .28931E-02        -.12   .025      20.00
    33    473       .3       .0   -6  -.85434E-04   .28937E-02        -.12   .025      20.00
    34    474       .3       .0   -6  -.85434E-04   .28937E-02        -.12   .025      20.00
    35    475       .4       .0   -6  -.85429E-04   .28935E-02        -.12   .025      20.00
    36    476       .4       .0   -6  -.85424E-04   .28934E-02        -.12   .025      20.00
    37    477       .4       .0   -6  -.85426E-04   .28935E-02        -.12   .025      20.00
    38    478       .4       .0   -6  -.85423E-04   .28934E-02        -.12   .025      20.00
    39    479       .5       .0   -6  -.85425E-04   .28934E-02        -.12   .025      20.00
    40    480       .5       .0   -6  -.85437E-04   .28938E-02        -.12   .025      20.00
    41    481       .5       .0   -6  -.85458E-04   .28946E-02        -.12   .025      20.00
    42    482       .6       .0   -6  -.85469E-04   .28950E-02        -.12   .025      20.00
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   43    483       .6       .0   -6  -.85474E-04   .28951E-02       -.12   .025     20.00
   44    484       .6       .0   -6  -.42737E-04   .28951E-02       -.12   .025     20.00


 Time:            5.5000

    i       n        x         z    Code       Q            v             h         th       Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]            [V/T]        [L/T]          [L]        [-]       [C]     [M/L3]
[VM/T.L3]

    1       1       .0       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
    2       2       .0       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
    3       3       .1       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
    4       4       .1       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
    5       5       .1       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
    6       6       .1       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
    7       7       .2       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
    8       8       .2       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
    9       9       .2       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   10      10       .3       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   11      11       .3       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   12      12       .3       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   13      13       .4       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   14      14       .4       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   15      15       .4       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   16      16       .4       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   17      17       .5       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   18      18       .5       1.0   -4   .00000E+00   .00000E+00       -.35   .170     20.00
   19      19       .5       1.0   -4   .00000E+00   .00000E+00       -.35   .169     20.00
   20      20       .6       1.0   -4   .00000E+00   .00000E+00       -.35   .169     20.00
   21      21       .6       1.0   -4   .00000E+00   .00000E+00       -.35   .169     20.00
   22      22       .6       1.0   -4   .00000E+00   .00000E+00       -.35   .169     20.00
   23     463       .0        .0   -6  -.42613E-04   .28867E-02       -.12   .025     20.00
   24     464       .0        .0   -6  -.85257E-04   .28877E-02       -.12   .025     20.00
   25     465       .1        .0   -6  -.85378E-04   .28918E-02       -.12   .025     20.00
   26     466       .1        .0   -6  -.85339E-04   .28905E-02       -.12   .025     20.00
   27     467       .1        .0   -6  -.85271E-04   .28882E-02       -.12   .025     20.00
   28     468       .1        .0   -6  -.85245E-04   .28873E-02       -.12   .025     20.00
   29     469       .2        .0   -6  -.85239E-04   .28871E-02       -.12   .025     20.00
   30     470       .2        .0   -6  -.85238E-04   .28871E-02       -.12   .025     20.00
   31     471       .2        .0   -6  -.85242E-04   .28873E-02       -.12   .025     20.00
   32     472       .3        .0   -6  -.85250E-04   .28875E-02       -.12   .025     20.00
   33     473       .3        .0   -6  -.85259E-04   .28878E-02       -.12   .025     20.00
   34     474       .3        .0   -6  -.85269E-04   .28881E-02       -.12   .025     20.00
   35     475       .4        .0   -6  -.85280E-04   .28885E-02       -.12   .025     20.00
   36     476       .4        .0   -6  -.85291E-04   .28889E-02       -.12   .025     20.00
   37     477       .4        .0   -6  -.85303E-04   .28893E-02       -.12   .025     20.00
   38     478       .4        .0   -6  -.85316E-04   .28897E-02       -.12   .025     20.00
   39     479       .5        .0   -6  -.85328E-04   .28901E-02       -.12   .025     20.00
   40     480       .5        .0   -6  -.85338E-04   .28904E-02       -.12   .025     20.00
   41     481       .5        .0   -6  -.85345E-04   .28907E-02       -.12   .025     20.00
   42     482       .6        .0   -6  -.85351E-04   .28910E-02       -.12   .025     20.00
   43     483       .6        .0   -6  -.85357E-04   .28911E-02       -.12   .025     20.00
   44     484       .6        .0   -6  -.42680E-04   .28912E-02       -.12   .025     20.00


 Time:            6.0000

    i       n        x         z    Code       Q            v             h         th       Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]            [V/T]        [L/T]          [L]        [-]       [C]     [M/L3]
[VM/T.L3]

    1       1       .0       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
    2       2       .0       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
    3       3       .1       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
    4       4       .1       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
    5       5       .1       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
    6       6       .1       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
    7       7       .2       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
    8       8       .2       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
    9       9       .2       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
   10      10       .3       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
   11      11       .3       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
   12      12       .3       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
   13      13       .4       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
   14      14       .4       1.0   -4   .00000E+00   .00000E+00       -.35   .167     20.00
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    15     15         .4        1.0    -4    .00000E+00    .00000E+00        -.35    .167      20.00
    16     16         .4        1.0    -4    .00000E+00    .00000E+00        -.35    .167      20.00
    17     17         .5        1.0    -4    .00000E+00    .00000E+00        -.35    .167      20.00
    18     18         .5        1.0    -4    .00000E+00    .00000E+00        -.35    .167      20.00
    19     19         .5        1.0    -4    .00000E+00    .00000E+00        -.35    .167      20.00
    20     20         .6        1.0    -4    .00000E+00    .00000E+00        -.35    .167      20.00
    21     21         .6        1.0    -4    .00000E+00    .00000E+00        -.35    .167      20.00
    22     22         .6        1.0    -4    .00000E+00    .00000E+00        -.36    .167      20.00
    23    463         .0         .0    -6   -.42502E-04    .28791E-02        -.12    .025      20.00
    24    464         .0         .0    -6   -.85012E-04    .28794E-02        -.12    .025      20.00
    25    465         .1         .0    -6   -.85033E-04    .28801E-02        -.12    .025      20.00
    26    466         .1         .0    -6   -.85054E-04    .28809E-02        -.12    .025      20.00
    27    467         .1         .0    -6   -.85072E-04    .28815E-02        -.12    .025      20.00
    28    468         .1         .0    -6   -.85085E-04    .28819E-02        -.12    .025      20.00
    29    469         .2         .0    -6   -.85094E-04    .28822E-02        -.12    .025      20.00
    30    470         .2         .0    -6   -.85101E-04    .28825E-02        -.12    .025      20.00
    31    471         .2         .0    -6   -.85110E-04    .28828E-02        -.12    .025      20.00
    32    472         .3         .0    -6   -.85121E-04    .28831E-02        -.12    .025      20.00
    33    473         .3         .0    -6   -.85134E-04    .28835E-02        -.12    .025      20.00
    34    474         .3         .0    -6   -.85148E-04    .28840E-02        -.12    .025      20.00
    35    475         .4         .0    -6   -.85165E-04    .28846E-02        -.12    .025      20.00
    36    476         .4         .0    -6   -.85182E-04    .28852E-02        -.12    .025      20.00
    37    477         .4         .0    -6   -.85202E-04    .28859E-02        -.12    .025      20.00
    38    478         .4         .0    -6   -.85224E-04    .28866E-02        -.12    .025      20.00
    39    479         .5         .0    -6   -.85243E-04    .28872E-02        -.12    .025      20.00
    40    480         .5         .0    -6   -.85261E-04    .28878E-02        -.12    .025      20.00
    41    481         .5         .0    -6   -.85274E-04    .28883E-02        -.12    .025      20.00
    42    482         .6         .0    -6   -.85286E-04    .28887E-02        -.12    .025      20.00
    43    483         .6         .0    -6   -.85295E-04    .28890E-02        -.12    .025      20.00
    44    484         .6         .0    -6   -.42649E-04    .28891E-02        -.12    .025      20.00


  Time:             6.5000

     i       n        x          z    Code        Q             v            h        th        Temp   Conc(1-NS)
 Qc(1-NS)
                     [L]        [L]             [V/T]         [L/T]         [L]       [-]        [C]      [M/L3]

 [VM/T.L3]

     1       1        .0        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
     2       2        .0        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
     3       3        .1        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
     4       4        .1        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
     5       5        .1        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
     6       6        .1        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
     7       7        .2        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
     8       8        .2        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
     9       9        .2        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    10      10        .3        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    11      11        .3        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    12      12        .3        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    13      13        .4        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    14      14        .4        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    15      15        .4        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    16      16        .4        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    17      17        .5        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    18      18        .5        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    19      19        .5        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    20      20        .6        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    21      21        .6        1.0    -4    .00000E+00    .00000E+00        -.36    .165      20.00
    22      22        .6        1.0    -4    .00000E+00    .00000E+00        -.36    .164      20.00
    23     463        .0         .0    -6   -.42439E-04    .28749E-02        -.12    .025      20.00
    24     464        .0         .0    -6   -.84884E-04    .28751E-02        -.12    .025      20.00
    25     465        .1         .0    -6   -.84889E-04    .28753E-02        -.12    .025      20.00
    26     466        .1         .0    -6   -.84894E-04    .28755E-02        -.12    .025      20.00
    27     467        .1         .0    -6   -.84901E-04    .28757E-02        -.12    .025      20.00
    28     468        .1         .0    -6   -.84909E-04    .28759E-02        -.12    .025      20.00
    29     469        .2         .0    -6   -.84917E-04    .28762E-02        -.12    .025      20.00
    30     470        .2         .0    -6   -.84924E-04    .28765E-02        -.12    .025      20.00
    31     471        .2         .0    -6   -.84933E-04    .28768E-02        -.12    .025      20.00
    32     472        .3         .0    -6   -.84944E-04    .28771E-02        -.12    .025      20.00
    33     473        .3         .0    -6   -.84956E-04    .28775E-02        -.12    .025      20.00
    34     474        .3         .0    -6   -.84969E-04    .28780E-02        -.12    .025      20.00
    35     475        .4         .0    -6   -.84984E-04    .28785E-02        -.12    .025      20.00
    36     476        .4         .0    -6   -.84999E-04    .28790E-02        -.12    .025      20.00
    37     477        .4         .0    -6   -.85017E-04    .28796E-02        -.12    .025      20.00
    38     478        .4         .0    -6   -.85036E-04    .28802E-02        -.12    .025      20.00
    39     479        .5         .0    -6   -.85052E-04    .28808E-02        -.12    .025      20.00
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    40     480       .5        .0    -6  -.85068E-04   .28813E-02       -.12   .025      20.00
    41     481       .5        .0    -6  -.85078E-04   .28817E-02       -.12   .025      20.00
    42     482       .6        .0    -6  -.85087E-04   .28820E-02       -.12   .025      20.00
    43     483       .6        .0    -6  -.85095E-04   .28822E-02       -.12   .025      20.00
    44     484       .6        .0    -6  -.42551E-04   .28825E-02       -.12   .025      20.00

 Time:            7.0000

     i       n       x         z     Code       Q            v            h       th        Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]              [V/T]        [L/T]        [L]      [-]        [C]     [M/L3]
 [VM/T.L3]

     1       1       .0       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
     2       2       .0       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
     3       3       .1       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
     4       4       .1       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
     5       5       .1       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
     6       6       .1       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
     7       7       .2       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
     8       8       .2       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
     9       9       .2       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    10      10       .3       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    11      11       .3       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    12      12       .3       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    13      13       .4       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    14      14       .4       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    15      15       .4       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    16      16       .4       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    17      17       .5       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    18      18       .5       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    19      19       .5       1.0    -4   .00000E+00   .00000E+00       -.37   .163      20.00
    20      20       .6       1.0    -4   .00000E+00   .00000E+00       -.37   .162      20.00
    21      21       .6       1.0    -4   .00000E+00   .00000E+00       -.37   .162      20.00
    22      22       .6       1.0    -4   .00000E+00   .00000E+00       -.37   .162      20.00
    23     463       .0        .0    -6  -.42158E-04   .28559E-02       -.12   .025      20.00
    24     464       .0        .0    -6  -.84336E-04   .28565E-02       -.12   .025      20.00
    25     465       .1        .0    -6  -.84338E-04   .28566E-02       -.12   .025      20.00
    26     466       .1        .0    -6  -.84337E-04   .28566E-02       -.12   .025      20.00
    27     467       .1        .0    -6  -.84337E-04   .28566E-02       -.12   .025      20.00
    28     468       .1        .0    -6  -.84338E-04   .28566E-02       -.12   .025      20.00
    29     469       .2        .0    -6  -.84341E-04   .28567E-02       -.12   .025      20.00
    30     470       .2        .0    -6  -.84343E-04   .28568E-02       -.12   .025      20.00
    31     471       .2        .0    -6  -.84348E-04   .28570E-02       -.12   .025      20.00
    32     472       .3        .0    -6  -.84355E-04   .28572E-02       -.12   .025      20.00
    33     473       .3        .0    -6  -.84361E-04   .28574E-02       -.12   .025      20.00
    34     474       .3        .0    -6  -.84369E-04   .28576E-02       -.12   .025      20.00
    35     475       .4        .0    -6  -.84377E-04   .28579E-02       -.12   .025      20.00
    36     476       .4        .0    -6  -.84385E-04   .28582E-02       -.12   .025      20.00
    37     477       .4        .0    -6  -.84394E-04   .28585E-02       -.12   .025      20.00
    38     478       .4        .0    -6  -.84405E-04   .28588E-02       -.12   .025      20.00
    39     479       .5        .0    -6  -.84412E-04   .28591E-02       -.12   .025      20.00
    40     480       .5        .0    -6  -.84418E-04   .28593E-02       -.12   .025      20.00
    41     481       .5        .0    -6  -.84421E-04   .28594E-02       -.12   .025      20.00
    42     482       .6        .0    -6  -.84423E-04   .28595E-02       -.12   .025      20.00
    43     483       .6        .0    -6  -.84429E-04   .28597E-02       -.12   .025      20.00
    44     484       .6        .0    -6  -.42226E-04   .28604E-02       -.12   .025      20.00

 Time:            7.5000

     i       n       x         z     Code       Q            v            h       th        Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]              [V/T]        [L/T]        [L]      [-]        [C]     [M/L3]
 [VM/T.L3]

     1       1       .0       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
     2       2       .0       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
     3       3       .1       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
     4       4       .1       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
     5       5       .1       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
     6       6       .1       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
     7       7       .2       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
     8       8       .2       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
     9       9       .2       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
    10      10       .3       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
    11      11       .3       1.0    -4   .00000E+00   .00000E+00       -.37   .161      20.00
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    12      12        .3      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    13      13        .4      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    14      14        .4      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    15      15        .4      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    16      16        .4      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    17      17        .5      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    18      18        .5      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    19      19        .5      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    20      20        .6      1.0    -4    .00000E+00    .00000E+00       -.37    .161      20.00
    21      21        .6      1.0    -4    .00000E+00    .00000E+00       -.38    .161      20.00
    22      22        .6      1.0    -4    .00000E+00    .00000E+00       -.38    .160      20.00
    23     463        .0       .0    -6   -.40109E-04    .27171E-02       -.12    .024      20.00
    24     464        .0       .0    -6   -.80323E-04    .27206E-02       -.12    .024      20.00
    25     465        .1       .0    -6   -.80341E-04    .27212E-02       -.12    .024      20.00
    26     466        .1       .0    -6   -.80334E-04    .27210E-02       -.12    .024      20.00
    27     467        .1       .0    -6   -.80322E-04    .27206E-02       -.12    .024      20.00
    28     468        .1       .0    -6   -.80311E-04    .27202E-02       -.12    .024      20.00
    29     469        .2       .0    -6   -.80302E-04    .27199E-02       -.12    .024      20.00
    30     470        .2       .0    -6   -.80292E-04    .27196E-02       -.12    .024      20.00
    31     471        .2       .0    -6   -.80285E-04    .27194E-02       -.12    .024      20.00
    32     472        .3       .0    -6   -.80280E-04    .27191E-02       -.12    .024      20.00
    33     473        .3       .0    -6   -.80273E-04    .27189E-02       -.12    .024      20.00
    34     474        .3       .0    -6   -.80267E-04    .27187E-02       -.12    .024      20.00
    35     475        .4       .0    -6   -.80261E-04    .27185E-02       -.12    .024      20.00
    36     476        .4       .0    -6   -.80252E-04    .27182E-02       -.12    .024      20.00
    37     477        .4       .0    -6   -.80244E-04    .27180E-02       -.12    .024      20.00
    38     478        .4       .0    -6   -.80237E-04    .27177E-02       -.12    .024      20.00
    39     479        .5       .0    -6   -.80228E-04    .27174E-02       -.12    .024      20.00
    40     480        .5       .0    -6   -.80219E-04    .27171E-02       -.12    .024      20.00
    41     481        .5       .0    -6   -.80210E-04    .27168E-02       -.12    .024      20.00
    42     482        .6       .0    -6   -.80210E-04    .27168E-02       -.12    .024      20.00
    43     483        .6       .0    -6   -.80230E-04    .27175E-02       -.12    .024      20.00
    44     484        .6       .0    -6   -.40156E-04    .27202E-02       -.12    .024      20.00


  Time:             8.0000

     i       n        x         z     Code        Q            v           h         th        Temp    Conc(1-NS)
 Qc(1-NS)
                     [L]       [L]               [V/T]        [L/T]        [L]        [-]        [C]      [M/L3]
 [VM/T.L3]

     1       1        .0      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
     2       2        .0      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
     3       3        .1      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
     4       4        .1      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
     5       5        .1      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
     6       6        .1      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
     7       7        .2      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
     8       8        .2      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
     9       9        .2      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    10      10        .3      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    11      11        .3      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    12      12        .3      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    13      13        .4      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    14      14        .4      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    15      15        .4      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    16      16        .4      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    17      17        .5      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    18      18        .5      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    19      19        .5      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    20      20        .6      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    21      21        .6      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    22      22        .6      1.0    -4    .00000E+00    .00000E+00       -.38    .159      20.00
    23     463        .0       .0    -6   -.39376E-04    .26674E-02       -.13    .024      20.00
    24     464        .0       .0    -6   -.78784E-04    .26685E-02       -.13    .024      20.00
    25     465        .1       .0    -6   -.78769E-04    .26680E-02       -.13    .024      20.00
    26     466        .1       .0    -6   -.78751E-04    .26674E-02       -.13    .024      20.00
    27     467        .1       .0    -6   -.78737E-04    .26669E-02       -.13    .024      20.00
    28     468        .1       .0    -6   -.78727E-04    .26665E-02       -.13    .024      20.00
    29     469        .2       .0    -6   -.78719E-04    .26663E-02       -.13    .024      20.00
    30     470        .2       .0    -6   -.78712E-04    .26661E-02       -.13    .024      20.00
    31     471        .2       .0    -6   -.78706E-04    .26659E-02       -.13    .024      20.00
    32     472        .3       .0    -6   -.78702E-04    .26657E-02       -.13    .024      20.00
    33     473        .3       .0    -6   -.78697E-04    .26655E-02       -.13    .024      20.00
    34     474        .3       .0    -6   -.78692E-04    .26654E-02       -.13    .024      20.00
    35     475        .4       .0    -6   -.78687E-04    .26652E-02       -.13    .024      20.00
    36     476        .4       .0    -6   -.78680E-04    .26650E-02       -.13    .024      20.00
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    37    477       .4        .0    -6  -.78674E-04   .26648E-02       -.13    .024      20.00
    38    478       .4        .0    -6  -.78668E-04   .26645E-02       -.13    .024      20.00
    39    479       .5        .0    -6  -.78658E-04   .26642E-02       -.13    .024      20.00
    40    480       .5        .0    -6  -.78645E-04   .26638E-02       -.13    .024      20.00
    41    481       .5        .0    -6  -.78627E-04   .26632E-02       -.13    .024      20.00
    42    482       .6        .0    -6  -.78607E-04   .26625E-02       -.13    .024      20.00
    43    483       .6        .0    -6  -.78593E-04   .26620E-02       -.13    .024      20.00
    44    484       .6        .0    -6  -.39307E-04   .26627E-02       -.13    .024      20.00


  Time:              8.5000

      i       n       x         z    Code       Q             v            h        th        Temp    Conc(1-NS)
 Qc(1-NS)
                     [L]       [L]             [V/T]         [L/T]         [L]       [-]       [C]     [M/L3]
 [VM/T.L3]

     1       1       .0       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
     2       2       .0       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
     3       3       .1       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
     4       4       .1       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
     5       5       .1       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
     6       6       .1       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
     7       7       .2       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
     8       8       .2       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
     9       9       .2       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    10      10       .3       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    11      11       .3       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    12      12       .3       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    13      13       .4       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    14      14       .4       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    15      15       .4       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    16      16       .4       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    17      17       .5       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    18      18       .5       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    19      19       .5       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    20      20       .6       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    21      21       .6       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    22      22       .6       1.0   -4   .00000E+00   .00000E+00       -.39    .158      20.00
    23     463       .0        .0   -6  -.37138E-04   .25158E-02       -.13    .023      20.00
    24     464       .0        .0   -6  -.74293E-04   .25164E-02       -.13    .023      20.00
    25     465       .1        .0   -6  -.74265E-04   .25154E-02       -.13    .023      20.00
    26     466       .1        .0   -6  -.74238E-04   .25145E-02       -.13    .023      20.00
    27     467       .1        .0   -6  -.74219E-04   .25139E-02       -.13    .023      20.00
    28     468       .1        .0   -6  -.74207E-04   .25134E-02       -.13    .023      20.00
    29     469       .2        .0   -6  -.74197E-04   .25131E-02       -.13    .023      20.00
    30     470       .2        .0   -6  -.74188E-04   .25128E-02       -.13    .023      20.00
    31     471       .2        .0   -6  -.74180E-04   .25126E-02       -.13    .023      20.00
    32     472       .3        .0   -6  -.74174E-04   .25123E-02       -.13    .023      20.00
    33     473       .3        .0   -6  -.74166E-04   .25121E-02       -.13    .023      20.00
    34     474       .3        .0   -6  -.74157E-04   .25118E-02       -.13    .023      20.00
    35     475       .4        .0   -6  -.74148E-04   .25115E-02       -.13    .023      20.00
    36     476       .4        .0   -6  -.74138E-04   .25111E-02       -.13    .023      20.00
    37     477       .4        .0   -6  -.74127E-04   .25108E-02       -.13    .023      20.00
    38     478       .4        .0   -6  -.74118E-04   .25104E-02       -.13    .023      20.00
    39     479       .5        .0   -6  -.74104E-04   .25100E-02       -.13    .023      20.00
    40     480       .5        .0   -6  -.74088E-04   .25094E-02       -.13    .023      20.00
    41     481       .5        .0   -6  -.74066E-04   .25087E-02       -.13    .023      20.00
    42     482       .6        .0   -6  -.74041E-04   .25079E-02       -.13    .023      20.00
    43     483       .6        .0   -6  -.74022E-04   .25072E-02       -.13    .023      20.00
    44     484       .6        .0   -6  -.37016E-04   .25075E-02       -.13    .023      20.00


  Time:              9.0000

      i       n       x         z    Code       Q             v            h        th        Temp    Conc(1-NS)
 Qc(1-NS)
                     [L]       [L]             [V/T]         [L/T]         [L]       [-]       [C]     [M/L3]
 [VM/T.L3]

     1       1       .0       1.0   -4   .00000E+00   .00000E+00       -.39    .157      20.00
     2       2       .0       1.0   -4   .00000E+00   .00000E+00       -.39    .157      20.00
     3       3       .1       1.0   -4   .00000E+00   .00000E+00       -.39    .157      20.00
     4       4       .1       1.0   -4   .00000E+00   .00000E+00       -.39    .157      20.00
     5       5       .1       1.0   -4   .00000E+00   .00000E+00       -.39    .157      20.00
     6       6       .1       1.0   -4   .00000E+00   .00000E+00       -.39    .157      20.00
     7       7       .2       1.0   -4   .00000E+00   .00000E+00       -.39    .157      20.00
     8       8       .2       1.0   -4   .00000E+00   .00000E+00       -.39    .157      20.00
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    9      9       .2      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   10     10       .3      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   11     11       .3      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   12     12       .3      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   13     13       .4      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   14     14       .4      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   15     15       .4      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   16     16       .4      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   17     17       .5      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   18     18       .5      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   19     19       .5      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   20     20       .6      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   21     21       .6      1.0   -4   .00000E+00   .00000E+00        -.39   .157      20.00
   22     22       .6      1.0   -4   .00000E+00   .00000E+00        -.39   .156      20.00
   23    463       .0       .0   -6  -.34180E-04   .23154E-02        -.13   .022      20.00
   24    464       .0       .0   -6  -.68273E-04   .23125E-02        -.13   .022      20.00
   25    465       .1       .0   -6  -.68208E-04   .23103E-02        -.13   .022      20.00
   26    466       .1       .0   -6  -.68188E-04   .23096E-02        -.13   .022      20.00
   27    467       .1       .0   -6  -.68187E-04   .23095E-02        -.13   .022      20.00
   28    468       .1       .0   -6  -.68188E-04   .23096E-02        -.13   .022      20.00
   29    469       .2       .0   -6  -.68188E-04   .23096E-02        -.13   .022      20.00
   30    470       .2       .0   -6  -.68184E-04   .23095E-02        -.13   .022      20.00
   31    471       .2       .0   -6  -.68179E-04   .23093E-02        -.13   .022      20.00
   32    472       .3       .0   -6  -.68173E-04   .23091E-02        -.13   .022      20.00
   33    473       .3       .0   -6  -.68165E-04   .23088E-02        -.13   .022      20.00
   34    474       .3       .0   -6  -.68157E-04   .23085E-02        -.13   .022      20.00
   35    475       .4       .0   -6  -.68148E-04   .23082E-02        -.13   .022      20.00
   36    476       .4       .0   -6  -.68138E-04   .23079E-02        -.13   .022      20.00
   37    477       .4       .0   -6  -.68131E-04   .23077E-02        -.13   .022      20.00
   38    478       .4       .0   -6  -.68128E-04   .23075E-02        -.13   .022      20.00
   39    479       .5       .0   -6  -.68127E-04   .23075E-02        -.13   .022      20.00
   40    480       .5       .0   -6  -.68132E-04   .23077E-02        -.13   .022      20.00
   41    481       .5       .0   -6  -.68138E-04   .23079E-02        -.13   .022      20.00
   42    482       .6       .0   -6  -.68135E-04   .23078E-02        -.13   .022      20.00
   43    483       .6       .0   -6  -.68083E-04   .23060E-02        -.13   .022      20.00
   44    484       .6       .0   -6  -.33978E-04   .23017E-02        -.13   .022      20.00


 Time:             9.5000

    i      n       x        z    Code       Q             v              h        th       Temp   Conc(1-NS)
Qc(1-NS)
                  [L]      [L]            [V/T]         [L/T]          [L]       [-]       [C]     [M/L3]
[VM/T.L3]

    1      1       .0      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
    2      2       .0      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
    3      3       .1      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
    4      4       .1      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
    5      5       .1      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
    6      6       .1      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
    7      7       .2      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
    8      8       .2      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
    9      9       .2      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   10     10       .3      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   11     11       .3      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   12     12       .3      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   13     13       .4      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   14     14       .4      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   15     15       .4      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   16     16       .4      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   17     17       .5      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   18     18       .5      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   19     19       .5      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   20     20       .6      1.0   -4   .00000E+00   .00000E+00        -.40   .156      20.00
   21     21       .6      1.0   -4   .00000E+00   .00000E+00        -.40   .155      20.00
   22     22       .6      1.0   -4   .00000E+00   .00000E+00        -.40   .155      20.00
   23    463       .0       .0   -6  -.28591E-04   .19368E-02        -.13   .020      20.00
   24    464       .0       .0   -6  -.57168E-04   .19363E-02        -.13   .020      20.00
   25    465       .1       .0   -6  -.57351E-04   .19425E-02        -.13   .020      20.00
   26    466       .1       .0   -6  -.57483E-04   .19470E-02        -.13   .020      20.00
   27    467       .1       .0   -6  -.57550E-04   .19493E-02        -.13   .020      20.00
   28    468       .1       .0   -6  -.57579E-04   .19502E-02        -.13   .020      20.00
   29    469       .2       .0   -6  -.57590E-04   .19506E-02        -.13   .020      20.00
   30    470       .2       .0   -6  -.57592E-04   .19507E-02        -.13   .020      20.00
   31    471       .2       .0   -6  -.57589E-04   .19506E-02        -.13   .020      20.00
   32    472       .3       .0   -6  -.57583E-04   .19504E-02        -.13   .020      20.00
   33    473       .3       .0   -6  -.57573E-04   .19500E-02        -.13   .020      20.00
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     34     474       .3       .0    -6   -.57562E-04    .19497E-02       -.13    .020      20.00
     35     475       .4       .0    -6   -.57551E-04    .19493E-02       -.13    .020      20.00
     36     476       .4       .0    -6   -.57540E-04    .19490E-02       -.13    .020      20.00
     37     477       .4       .0    -6   -.57532E-04    .19487E-02       -.13    .020      20.00
     38     478       .4       .0    -6   -.57529E-04    .19485E-02       -.13    .020      20.00
     39     479       .5       .0    -6   -.57529E-04    .19485E-02       -.13    .020      20.00
     40     480       .5       .0    -6   -.57533E-04    .19487E-02       -.13    .020      20.00
     41     481       .5       .0    -6   -.57544E-04    .19491E-02       -.13    .020      20.00
     42     482       .6       .0    -6   -.57564E-04    .19498E-02       -.13    .020      20.00
     43     483       .6       .0    -6   -.57594E-04    .19507E-02       -.13    .020      20.00
     44     484       .6       .0    -6   -.28808E-04    .19515E-02       -.13    .020      20.00


  Time:            10.0000

      i       n       x         z    Code        Q             v            h         th        Temp   Conc(1-NS)
 Qc(1-NS)
                     [L]       [L]            [V/T]         [L/T]          [L]       [-]        [C]      [M/L3]
  [VM/T.L3]

      1       1       .0      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
      2       2       .0      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
      3       3       .1      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
      4       4       .1      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
      5       5       .1      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
      6       6       .1      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
      7       7       .2      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
      8       8       .2      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
      9       9       .2      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     10      10       .3      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     11      11       .3      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     12      12       .3      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     13      13       .4      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     14      14       .4      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     15      15       .4      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     16      16       .4      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     17      17       .5      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     18      18       .5      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     19      19       .5      1.0    -4    .00000E+00    .00000E+00       -.40    .155      20.00
     20      20       .6      1.0    -4    .00000E+00    .00000E+00       -.40    .154      20.00
     21      21       .6      1.0    -4    .00000E+00    .00000E+00       -.40    .154      20.00
     22      22       .6      1.0    -4    .00000E+00    .00000E+00       -.40    .154      20.00
     23     463       .0       .0    -6   -.25245E-04    .17102E-02       -.14    .019      20.00
     24     464       .0       .0    -6   -.50498E-04    .17104E-02       -.14    .019      20.00
     25     465       .1       .0    -6   -.50474E-04    .17096E-02       -.14    .019      20.00
     26     466       .1       .0    -6   -.50476E-04    .17097E-02       -.14    .019      20.00
     27     467       .1       .0    -6   -.50491E-04    .17102E-02       -.14    .019      20.00
     28     468       .1       .0    -6   -.50508E-04    .17107E-02       -.14    .019      20.00
     29     469       .2       .0    -6   -.50520E-04    .17111E-02       -.14    .019      20.00
     30     470       .2       .0    -6   -.50525E-04    .17114E-02       -.14    .019      20.00
     31     471       .2       .0    -6   -.50525E-04    .17113E-02       -.14    .019      20.00
     32     472       .3       .0    -6   -.50521E-04    .17112E-02       -.14    .019      20.00
     33     473       .3       .0    -6   -.50512E-04    .17109E-02       -.14    .019      20.00
     34     474       .3       .0    -6   -.50501E-04    .17105E-02       -.14    .019      20.00
     35     475       .4       .0    -6   -.50491E-04    .17102E-02       -.14    .019      20.00
     36     476       .4       .0    -6   -.50483E-04    .17099E-02       -.14    .019      20.00
     37     477       .4       .0    -6   -.50478E-04    .17098E-02       -.14    .019      20.00
     38     478       .4       .0    -6   -.50479E-04    .17098E-02       -.14    .019      20.00
     39     479       .5       .0    -6   -.50481E-04    .17098E-02       -.14    .019      20.00
     40     480       .5       .0    -6   -.50484E-04    .17099E-02       -.14    .019      20.00
     41     481       .5       .0    -6   -.50481E-04    .17098E-02       -.14    .019      20.00
     42     482       .6       .0    -6   -.50469E-04    .17094E-02       -.14    .019      20.00
     43     483       .6       .0    -6   -.50454E-04    .17089E-02       -.14    .019      20.00
     44     484       .6       .0    -6   -.25239E-04    .17097E-02       -.14    .019      20.00


  Time:            10.5000

      i       n       x         z    Code        Q             v            h         th        Temp   Conc(1-NS)
 Qc(1-NS)
                     [L]       [L]            [V/T]         [L/T]          [L]       [-]        [C]      [M/L3]
  [VM/T.L3]

      1       1       .0      1.0    -4    .00000E+00    .00000E+00       -.41    .154      20.00
      2       2       .0      1.0    -4    .00000E+00    .00000E+00       -.41    .154      20.00
      3       3       .1      1.0    -4    .00000E+00    .00000E+00       -.41    .154      20.00
      4       4       .1      1.0    -4    .00000E+00    .00000E+00       -.41    .154      20.00
      5       5       .1      1.0    -4    .00000E+00    .00000E+00       -.41    .154      20.00
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     6     6      .1     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
     7     7      .2     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
     8     8      .2     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
     9     9      .2     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    10    10      .3     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    11    11      .3     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    12    12      .3     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    13    13      .4     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    14    14      .4     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    15    15      .4     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    16    16      .4     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    17    17      .5     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    18    18      .5     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    19    19      .5     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    20    20      .6     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    21    21      .6     1.0   -4   .00000E+00   .00000E+00      -.41   .154     20.00
    22    22      .6     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    23   463      .0      .0   -6  -.19806E-04   .13417E-02      -.14   .017     20.00
    24   464      .0      .0   -6  -.39953E-04   .13532E-02      -.14   .017     20.00
    25   465      .1      .0   -6  -.40059E-04   .13568E-02      -.14   .017     20.00
    26   466      .1      .0   -6  -.40122E-04   .13590E-02      -.14   .017     20.00
    27   467      .1      .0   -6  -.40170E-04   .13606E-02      -.14   .017     20.00
    28   468      .1      .0   -6  -.40207E-04   .13618E-02      -.14   .017     20.00
    29   469      .2      .0   -6  -.40230E-04   .13626E-02      -.14   .017     20.00
    30   470      .2      .0   -6  -.40242E-04   .13630E-02      -.14   .017     20.00
    31   471      .2      .0   -6  -.40244E-04   .13631E-02      -.14   .017     20.00
    32   472      .3      .0   -6  -.40239E-04   .13629E-02      -.14   .017     20.00
    33   473      .3      .0   -6  -.40229E-04   .13626E-02      -.14   .017     20.00
    34   474      .3      .0   -6  -.40217E-04   .13622E-02      -.14   .017     20.00
    35   475      .4      .0   -6  -.40206E-04   .13618E-02      -.14   .017     20.00
    36   476      .4      .0   -6  -.40199E-04   .13616E-02      -.14   .017     20.00
    37   477      .4      .0   -6  -.40198E-04   .13616E-02      -.14   .017     20.00
    38   478      .4      .0   -6  -.40207E-04   .13619E-02      -.14   .017     20.00
    39   479      .5      .0   -6  -.40226E-04   .13625E-02      -.14   .017     20.00
    40   480      .5      .0   -6  -.40255E-04   .13635E-02      -.14   .017     20.00
    41   481      .5      .0   -6  -.40292E-04   .13647E-02      -.14   .017     20.00
    42   482      .6      .0   -6  -.40334E-04   .13662E-02      -.14   .017     20.00
    43   483      .6      .0   -6  -.40394E-04   .13682E-02      -.14   .017     20.00
    44   484      .6      .0   -6  -.20310E-04   .13758E-02      -.14   .017     20.00


  Time:           11.0000

     i     n       x       z    Code      Q           v            h       th       Temp   Conc(1-NS)
 Qc(1-NS)
                  [L]     [L]           [V/T]       [L/T]         [L]      [-]       [C]     [M/L3]

 [VM/T.L3]

     1     1      .0     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
     2     2      .0     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
     3     3      .1     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
     4     4      .1     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
     5     5      .1     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
     6     6      .1     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
     7     7      .2     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
     8     8      .2     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
     9     9      .2     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    10    10      .3     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    11    11      .3     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    12    12      .3     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    13    13      .4     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    14    14      .4     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    15    15      .4     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    16    16      .4     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    17    17      .5     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    18    18      .5     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    19    19      .5     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    20    20      .6     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    21    21      .6     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    22    22      .6     1.0   -4   .00000E+00   .00000E+00      -.41   .153     20.00
    23   463      .0      .0   -6  -.17327E-04   .11738E-02      -.14   .016     20.00
    24   464      .0      .0   -6  -.34780E-04   .11780E-02      -.14   .016     20.00
    25   465      .1      .0   -6  -.34813E-04   .11791E-02      -.14   .016     20.00
    26   466      .1      .0   -6  -.34857E-04   .11806E-02      -.14   .016     20.00
    27   467      .1      .0   -6  -.34902E-04   .11822E-02      -.14   .016     20.00
    28   468      .1      .0   -6  -.34939E-04   .11834E-02      -.14   .016     20.00
    29   469      .2      .0   -6  -.34963E-04   .11842E-02      -.14   .016     20.00
    30   470      .2      .0   -6  -.34973E-04   .11846E-02      -.14   .016     20.00
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     31     471       .2       .0    -6  -.34973E-04   .11846E-02       -.14   .016      20.00
     32     472       .3       .0    -6  -.34965E-04   .11843E-02       -.14   .016      20.00
     33     473       .3       .0    -6  -.34952E-04   .11839E-02       -.14   .016      20.00
     34     474       .3       .0    -6  -.34937E-04   .11834E-02       -.14   .016      20.00
     35     475       .4       .0    -6  -.34924E-04   .11829E-02       -.14   .016      20.00
     36     476       .4       .0    -6  -.34914E-04   .11826E-02       -.14   .016      20.00
     37     477       .4       .0    -6  -.34912E-04   .11825E-02       -.14   .016      20.00
     38     478       .4       .0    -6  -.34920E-04   .11828E-02       -.14   .016      20.00
     39     479       .5       .0    -6  -.34938E-04   .11834E-02       -.14   .016      20.00
     40     480       .5       .0    -6  -.34965E-04   .11843E-02       -.14   .016      20.00
     41     481       .5       .0    -6  -.34997E-04   .11854E-02       -.14   .016      20.00
     42     482       .6       .0    -6  -.35027E-04   .11864E-02       -.14   .016      20.00
     43     483       .6       .0    -6  -.35058E-04   .11874E-02       -.14   .016      20.00
     44     484       .6       .0    -6  -.17566E-04   .11899E-02       -.14   .016      20.00

  Time:           11.5000

      i       n        x         z     Code        Q            v            h        th       Temp   Conc(1-NS)
 Qc(1-NS)
                      [L]       [L]              [V/T]        [L/T]         [L]       [-]       [C]     [M/L3]
 [VM/T.L3]

      1       1       .0      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
      2       2       .0      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
      3       3       .1      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
      4       4       .1      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
      5       5       .1      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
      6       6       .1      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
      7       7       .2      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
      8       8       .2      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
      9       9       .2      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     10      10       .3      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     11      11       .3      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     12      12       .3      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     13      13       .4      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     14      14       .4      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     15      15       .4      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     16      16       .4      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     17      17       .5      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     18      18       .5      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     19      19       .5      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     20      20       .6      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     21      21       .6      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     22      22       .6      1.0    -4   .00000E+00   .00000E+00       -.41   .152      20.00
     23     463       .0       .0    -6  -.14665E-04   .99342E-03       -.14   .015      20.00
     24     464       .0       .0    -6  -.29434E-04   .99697E-03       -.14   .015      20.00
     25     465       .1       .0    -6  -.29467E-04   .99806E-03       -.14   .015      20.00
     26     466       .1       .0    -6  -.29505E-04   .99938E-03       -.14   .015      20.00
     27     467       .1       .0    -6  -.29544E-04   .10007E-02       -.14   .015      20.00
     28     468       .1       .0    -6  -.29571E-04   .10016E-02       -.14   .015      20.00
     29     469       .2       .0    -6  -.29581E-04   .10019E-02       -.14   .015      20.00
     30     470       .2       .0    -6  -.29571E-04   .10016E-02       -.14   .015      20.00
     31     471       .2       .0    -6  -.29536E-04   .10004E-02       -.14   .015      20.00
     32     472       .3       .0    -6  -.29473E-04   .99829E-03       -.14   .015      20.00
     33     473       .3       .0    -6  -.29382E-04   .99518E-03       -.14   .015      20.00
     34     474       .3       .0    -6  -.29270E-04   .99140E-03       -.14   .015      20.00
     35     475       .4       .0    -6  -.29156E-04   .98752E-03       -.14   .015      20.00
     36     476       .4       .0    -6  -.29062E-04   .98436E-03       -.14   .015      20.00
     37     477       .4       .0    -6  -.29005E-04   .98244E-03       -.14   .015      20.00
     38     478       .4       .0    -6  -.28984E-04   .98170E-03       -.14   .015      20.00
     39     479       .5       .0    -6  -.28991E-04   .98195E-03       -.14   .015      20.00
     40     480       .5       .0    -6  -.29021E-04   .98296E-03       -.14   .015      20.00
     41     481       .5       .0    -6  -.29064E-04   .98442E-03       -.14   .015      20.00
     42     482       .6       .0    -6  -.29113E-04   .98611E-03       -.14   .015      20.00
     43     483       .6       .0    -6  -.29162E-04   .98774E-03       -.14   .015      20.00
     44     484       .6       .0    -6  -.14610E-04   .98972E-03       -.14   .015      20.00

  Time:           12.0000

      i       n        x         z     Code        Q            v            h        th       Temp   Conc(1-NS)
 Qc(1-NS)
                      [L]       [L]              [V/T]        [L/T]         [L]       [-]       [C]     [M/L3]
 [VM/T.L3]

      1       1       .0      1.0    -4   .00000E+00   .00000E+00       -.42   .151      20.00
      2       2       .0      1.0    -4   .00000E+00   .00000E+00       -.42   .151      20.00
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    3      3       .1      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
    4      4       .1      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
    5      5       .1      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
    6      6       .1      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
    7      7       .2      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
    8      8       .2      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
    9      9       .2      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   10     10       .3      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   11     11       .3      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   12     12       .3      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   13     13       .4      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   14     14       .4      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   15     15       .4      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   16     16       .4      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   17     17       .5      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   18     18       .5      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   19     19       .5      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   20     20       .6      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   21     21       .6      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   22     22       .6      1.0   -4   .00000E+00   .00000E+00       -.42   .151     20.00
   23    463       .0       .0   -6  -.12058E-04   .81681E-03       -.14   .014     20.00
   24    464       .0       .0   -6  -.24283E-04   .82248E-03       -.14   .014     20.00
   25    465       .1       .0   -6  -.24302E-04   .82314E-03       -.14   .014     20.00
   26    466       .1       .0   -6  -.24327E-04   .82397E-03       -.14   .014     20.00
   27    467       .1       .0   -6  -.24357E-04   .82498E-03       -.14   .014     20.00
   28    468       .1       .0   -6  -.24381E-04   .82580E-03       -.14   .014     20.00
   29    469       .2       .0   -6  -.24395E-04   .82627E-03       -.14   .014     20.00
   30    470       .2       .0   -6  -.24400E-04   .82648E-03       -.14   .014     20.00
   31    471       .2       .0   -6  -.24410E-04   .82681E-03       -.14   .014     20.00
   32    472       .3       .0   -6  -.24442E-04   .82787E-03       -.14   .014     20.00
   33    473       .3       .0   -6  -.24512E-04   .83022E-03       -.14   .014     20.00
   34    474       .3       .0   -6  -.24624E-04   .83405E-03       -.14   .014     20.00
   35    475       .4       .0   -6  -.24767E-04   .83889E-03       -.14   .015     20.00
   36    476       .4       .0   -6  -.24910E-04   .84372E-03       -.14   .015     20.00
   37    477       .4       .0   -6  -.25024E-04   .84761E-03       -.14   .015     20.00
   38    478       .4       .0   -6  -.25102E-04   .85023E-03       -.14   .015     20.00
   39    479       .5       .0   -6  -.25147E-04   .85175E-03       -.14   .015     20.00
   40    480       .5       .0   -6  -.25171E-04   .85256E-03       -.14   .015     20.00
   41    481       .5       .0   -6  -.25180E-04   .85287E-03       -.14   .015     20.00
   42    482       .6       .0   -6  -.25165E-04   .85237E-03       -.14   .015     20.00
   43    483       .6       .0   -6  -.25125E-04   .85100E-03       -.14   .015     20.00
   44    484       .6       .0   -6  -.12555E-04   .85048E-03       -.14   .015     20.00


 Time:           12.5000

    i      n      x        z    Code       Q            v           h         th      Temp  Conc(1-NS)
Qc(1-NS)
                 [L]      [L]            [V/T]        [L/T]        [L]      [-]       [C]    [M/L3]

[VM/T.L3]

    1      1       .0      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
    2      2       .0      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
    3      3       .1      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
    4      4       .1      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
    5      5       .1      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
    6      6       .1      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
    7      7       .2      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
    8      8       .2      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
    9      9       .2      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   10     10       .3      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   11     11       .3      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   12     12       .3      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   13     13       .4      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   14     14       .4      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   15     15       .4      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   16     16       .4      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   17     17       .5      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   18     18       .5      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   19     19       .5      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   20     20       .6      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   21     21       .6      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   22     22       .6      1.0   -4   .00000E+00   .00000E+00       -.42   .150     20.00
   23    463       .0       .0   -6  -.93021E-05   .63015E-03       -.15   .013     20.00
   24    464       .0       .0   -6  -.18648E-04   .63162E-03       -.15   .013     20.00
   25    465       .1       .0   -6  -.18580E-04   .62931E-03       -.15   .013     20.00
   26    466       .1       .0   -6  -.18637E-04   .63127E-03       -.15   .013     20.00
   27    467       .1       .0   -6  -.18726E-04   .63425E-03       -.15   .013     20.00
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   28    468      .1       .0   -6  -.18791E-04   .63646E-03      -.15   .013     20.00
   29    469      .2       .0   -6  -.18824E-04   .63757E-03      -.15   .013     20.00
   30    470      .2       .0   -6  -.18830E-04   .63778E-03      -.15   .013     20.00
   31    471      .2       .0   -6  -.18818E-04   .63738E-03      -.15   .013     20.00
   32    472      .3       .0   -6  -.18796E-04   .63663E-03      -.15   .013     20.00
   33    473      .3       .0   -6  -.18770E-04   .63574E-03      -.14   .013     20.00
   34    474      .3       .0   -6  -.18743E-04   .63483E-03      -.14   .013     20.00
   35    475      .4       .0   -6  -.18719E-04   .63401E-03      -.14   .013     20.00
   36    476      .4       .0   -6  -.18699E-04   .63336E-03      -.14   .013     20.00
   37    477      .4       .0   -6  -.18686E-04   .63293E-03      -.14   .013     20.00
   38    478      .4       .0   -6  -.18679E-04   .63268E-03      -.14   .013     20.00
   39    479      .5       .0   -6  -.18673E-04   .63248E-03      -.14   .013     20.00
   40    480      .5       .0   -6  -.18662E-04   .63211E-03      -.14   .013     20.00
   41    481      .5       .0   -6  -.18651E-04   .63174E-03      -.14   .013     20.00
   42    482      .6       .0   -6  -.18692E-04   .63312E-03      -.14   .013     20.00
   43    483      .6       .0   -6  -.18910E-04   .64050E-03      -.14   .014     20.00
   44    484      .6       .0   -6  -.97386E-05   .65971E-03      -.14   .014     20.00

 Time:           13.0000

    i       n       x        z     Code       Q            v            h        th        Temp   Conc(1-NS)
Qc(1-NS)
                   [L]      [L]            [V/T]        [L/T]          [L]       [-]        [C]     [M/L3]
 [VM/T.L3]

    1       1      .0      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
    2       2      .0      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
    3       3      .1      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
    4       4      .1      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
    5       5      .1      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
    6       6      .1      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
    7       7      .2      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
    8       8      .2      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
    9       9      .2      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   10      10      .3      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   11      11      .3      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   12      12      .3      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   13      13      .4      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   14      14      .4      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   15      15      .4      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   16      16      .4      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   17      17      .5      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   18      18      .5      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   19      19      .5      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   20      20      .6      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   21      21      .6      1.0   -4   .00000E+00   .00000E+00      -.42   .150     20.00
   22      22      .6      1.0   -4   .00000E+00   .00000E+00      -.42   .149     20.00
   23     463      .0       .0   -6  -.94482E-05   .64004E-03      -.15   .014     20.00
   24     464      .0       .0   -6  -.18984E-04   .64300E-03      -.15   .014     20.00
   25     465      .1       .0   -6  -.19042E-04   .64497E-03      -.15   .014     20.00
   26     466      .1       .0   -6  -.19098E-04   .64685E-03      -.15   .014     20.00
   27     467      .1       .0   -6  -.19138E-04   .64824E-03      -.15   .014     20.00
   28     468      .1       .0   -6  -.19164E-04   .64910E-03      -.15   .014     20.00
   29     469      .2       .0   -6  -.19174E-04   .64945E-03      -.15   .014     20.00
   30     470      .2       .0   -6  -.19171E-04   .64936E-03      -.15   .014     20.00
   31     471      .2       .0   -6  -.19160E-04   .64896E-03      -.15   .014     20.00
   32     472      .3       .0   -6  -.19143E-04   .64838E-03      -.15   .014     20.00
   33     473      .3       .0   -6  -.19123E-04   .64770E-03      -.15   .014     20.00
   34     474      .3       .0   -6  -.19102E-04   .64701E-03      -.15   .014     20.00
   35     475      .4       .0   -6  -.19083E-04   .64635E-03      -.15   .014     20.00
   36     476      .4       .0   -6  -.19066E-04   .64578E-03      -.15   .014     20.00
   37     477      .4       .0   -6  -.19055E-04   .64541E-03      -.15   .014     20.00
   38     478      .4       .0   -6  -.19053E-04   .64534E-03      -.15   .014     20.00
   39     479      .5       .0   -6  -.19064E-04   .64570E-03      -.15   .014     20.00
   40     480      .5       .0   -6  -.19089E-04   .64657E-03      -.15   .014     20.00
   41     481      .5       .0   -6  -.19129E-04   .64793E-03      -.15   .014     20.00
   42     482      .6       .0   -6  -.19174E-04   .64945E-03      -.15   .014     20.00
   43     483      .6       .0   -6  -.19205E-04   .65048E-03      -.15   .014     20.00
   44     484      .6       .0   -6  -.96119E-05   .65113E-03      -.15   .014     20.00

 Time:           13.5000

    i       n       x        z     Code       Q            v            h        th        Temp   Conc(1-NS)
Qc(1-NS)
                   [L]      [L]            [V/T]        [L/T]          [L]       [-]        [C]     [M/L3]
 [VM/T.L3]
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```
     1      1      .0      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
     2      2      .0      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
     3      3      .1      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
     4      4      .1      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
     5      5      .1      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
     6      6      .1      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
     7      7      .2      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
     8      8      .2      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
     9      9      .2      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    10     10      .3      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    11     11      .3      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    12     12      .3      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    13     13      .4      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    14     14      .4      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    15     15      .4      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    16     16      .4      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    17     17      .5      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    18     18      .5      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    19     19      .5      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    20     20      .6      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    21     21      .6      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    22     22      .6      1.0    -4    .00000E+00    .00000E+00       -.43    .149     20.00
    23    463      .0       .0    -6   -.75275E-05    .50993E-03       -.15    .013     20.00
    24    464      .0       .0    -6   -.15576E-04    .52756E-03       -.15    .013     20.00
    25    465      .1       .0    -6   -.16079E-04    .54463E-03       -.15    .013     20.00
    26    466      .1       .0    -6   -.16414E-04    .55595E-03       -.15    .013     20.00
    27    467      .1       .0    -6   -.16599E-04    .56221E-03       -.15    .013     20.00
    28    468      .1       .0    -6   -.16692E-04    .56536E-03       -.15    .013     20.00
    29    469      .2       .0    -6   -.16731E-04    .56669E-03       -.15    .013     20.00
    30    470      .2       .0    -6   -.16738E-04    .56693E-03       -.15    .013     20.00
    31    471      .2       .0    -6   -.16727E-04    .56656E-03       -.15    .013     20.00
    32    472      .3       .0    -6   -.16708E-04    .56592E-03       -.15    .013     20.00
    33    473      .3       .0    -6   -.16687E-04    .56522E-03       -.15    .013     20.00
    34    474      .3       .0    -6   -.16668E-04    .56457E-03       -.15    .013     20.00
    35    475      .4       .0    -6   -.16653E-04    .56405E-03       -.15    .013     20.00
    36    476      .4       .0    -6   -.16644E-04    .56377E-03       -.15    .013     20.00
    37    477      .4       .0    -6   -.16647E-04    .56386E-03       -.15    .013     20.00
    38    478      .4       .0    -6   -.16663E-04    .56440E-03       -.15    .013     20.00
    39    479      .5       .0    -6   -.16687E-04    .56519E-03       -.15    .013     20.00
    40    480      .5       .0    -6   -.16691E-04    .56535E-03       -.15    .013     20.00
    41    481      .5       .0    -6   -.16636E-04    .56349E-03       -.15    .013     20.00
    42    482      .6       .0    -6   -.16502E-04    .55895E-03       -.15    .013     20.00
    43    483      .6       .0    -6   -.16358E-04    .55405E-03       -.15    .013     20.00
    44    484      .6       .0    -6   -.82156E-05    .55654E-03       -.15    .013     20.00


 Time:              14.0000

     i       n       x         z    Code        Q             v             h        th        Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]             [V/T]         [L/T]          [L]       [-]        [C]     [M/L3]
[VM/T.L3]

     1      1      .0      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
     2      2      .0      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
     3      3      .1      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
     4      4      .1      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
     5      5      .1      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
     6      6      .1      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
     7      7      .2      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
     8      8      .2      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
     9      9      .2      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    10     10      .3      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    11     11      .3      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    12     12      .3      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    13     13      .4      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    14     14      .4      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    15     15      .4      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    16     16      .4      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    17     17      .5      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    18     18      .5      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    19     19      .5      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    20     20      .6      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    21     21      .6      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    22     22      .6      1.0    -4    .00000E+00    .00000E+00       -.43    .148     20.00
    23    463      .0       .0    -6   -.66867E-05    .45297E-03       -.15    .013     20.00
    24    464      .0       .0    -6   -.12928E-04    .43788E-03       -.15    .012     20.00
```

```
     25     465       .1       .0    -6   -.12734E-04   .43132E-03        -.15   .012      20.00
     26     466       .1       .0    -6   -.12849E-04   .43520E-03        -.15   .012      20.00
     27     467       .1       .0    -6   -.13020E-04   .44100E-03        -.15   .013      20.00
     28     468       .1       .0    -6   -.13135E-04   .44490E-03        -.15   .013      20.00
     29     469       .2       .0    -6   -.13185E-04   .44660E-03        -.15   .013      20.00
     30     470       .2       .0    -6   -.13191E-04   .44681E-03        -.15   .013      20.00
     31     471       .2       .0    -6   -.13176E-04   .44628E-03        -.15   .013      20.00
     32     472       .3       .0    -6   -.13152E-04   .44546E-03        -.15   .013      20.00
     33     473       .3       .0    -6   -.13125E-04   .44457E-03        -.15   .013      20.00
     34     474       .3       .0    -6   -.13098E-04   .44365E-03        -.15   .013      20.00
     35     475       .4       .0    -6   -.13070E-04   .44271E-03        -.15   .013      20.00
     36     476       .4       .0    -6   -.13039E-04   .44166E-03        -.15   .013      20.00
     37     477       .4       .0    -6   -.13003E-04   .44044E-03        -.15   .013      20.00
     38     478       .4       .0    -6   -.12966E-04   .43915E-03        -.15   .013      20.00
     39     479       .5       .0    -6   -.12944E-04   .43844E-03        -.15   .013      20.00
     40     480       .5       .0    -6   -.12991E-04   .44000E-03        -.15   .013      20.00
     41     481       .5       .0    -6   -.13178E-04   .44635E-03        -.15   .013      20.00
     42     482       .6       .0    -6   -.13545E-04   .45878E-03        -.15   .013      20.00
     43     483       .6       .0    -6   -.14014E-04   .47467E-03        -.15   .013      20.00
     44     484       .6       .0    -6   -.72197E-05   .48907E-03        -.15   .013      20.00


   Time:           14.5000

      i        n        x          z     Code        Q             v             h        th         Temp   Conc(1-NS)
  Qc(1-NS)
                       [L]        [L]               [V/T]         [L/T]          [L]      [-]         [C]      [M/L3]
   [VM/T.L3]

      1        1       .0        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
      2        2       .0        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
      3        3       .1        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
      4        4       .1        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
      5        5       .1        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
      6        6       .1        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
      7        7       .2        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
      8        8       .2        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
      9        9       .2        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     10       10       .3        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     11       11       .3        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     12       12       .3        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     13       13       .4        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     14       14       .4        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     15       15       .4        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     16       16       .4        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     17       17       .5        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     18       18       .5        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     19       19       .5        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     20       20       .6        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     21       21       .6        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     22       22       .6        1.0    -4    .00000E+00   .00000E+00        -.43   .148      20.00
     23      463       .0         .0    -6   -.83018E-05   .56238E-03        -.15   .013      20.00
     24      464       .0         .0    -6   -.15178E-04   .51410E-03        -.15   .013      20.00
     25      465       .1         .0    -6   -.14380E-04   .48706E-03        -.15   .013      20.00
     26      466       .1         .0    -6   -.13930E-04   .47183E-03        -.15   .013      20.00
     27      467       .1         .0    -6   -.13735E-04   .46521E-03        -.15   .013      20.00
     28      468       .1         .0    -6   -.13771E-04   .46642E-03        -.15   .013      20.00
     29      469       .2         .0    -6   -.14055E-04   .47604E-03        -.15   .013      20.00
     30      470       .2         .0    -6   -.14479E-04   .49044E-03        -.15   .013      20.00
     31      471       .2         .0    -6   -.14819E-04   .50194E-03        -.15   .013      20.00
     32      472       .3         .0    -6   -.15000E-04   .50805E-03        -.15   .013      20.00
     33      473       .3         .0    -6   -.15034E-04   .50922E-03        -.15   .013      20.00
     34      474       .3         .0    -6   -.14917E-04   .50527E-03        -.15   .013      20.00
     35      475       .4         .0    -6   -.14633E-04   .49562E-03        -.15   .013      20.00
     36      476       .4         .0    -6   -.14229E-04   .48194E-03        -.15   .013      20.00
     37      477       .4         .0    -6   -.13854E-04   .46927E-03        -.15   .013      20.00
     38      478       .4         .0    -6   -.13621E-04   .46135E-03        -.15   .013      20.00
     39      479       .5         .0    -6   -.13518E-04   .45787E-03        -.15   .013      20.00
     40      480       .5         .0    -6   -.13542E-04   .45868E-03        -.15   .013      20.00
     41      481       .5         .0    -6   -.13759E-04   .46604E-03        -.15   .013      20.00
     42      482       .6         .0    -6   -.14115E-04   .47811E-03        -.15   .013      20.00
     43      483       .6         .0    -6   -.14320E-04   .48502E-03        -.15   .013      20.00
     44      484       .6         .0    -6   -.71462E-05   .48409E-03        -.15   .013      20.00


   Time:           15.0000
```

```
     i       n       x         z     Code        Q             v            h        th       Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]              [V/T]         [L/T]         [L]      [-]       [C]     [M/L3]
[VM/T.L3]

     1       1      .0       1.0    -4    .00000E+00    .00000E+00       -.43    .147     20.00
     2       2      .0       1.0    -4    .00000E+00    .00000E+00       -.43    .147     20.00
     3       3      .1       1.0    -4    .00000E+00    .00000E+00       -.43    .147     20.00
     4       4      .1       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     5       5      .1       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     6       6      .1       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     7       7      .2       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     8       8      .2       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     9       9      .2       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    10      10      .3       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    11      11      .3       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    12      12      .3       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    13      13      .4       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    14      14      .4       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    15      15      .4       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    16      16      .4       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    17      17      .5       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    18      18      .5       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    19      19      .5       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    20      20      .6       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    21      21      .6       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    22      22      .6       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    23     463      .0        .0    -6   -.61493E-05    .41657E-03       -.15    .012     20.00
    24     464      .0        .0    -6   -.12257E-04    .41517E-03       -.15    .012     20.00
    25     465      .1        .0    -6   -.12779E-04    .43285E-03       -.15    .013     20.00
    26     466      .1        .0    -6   -.13121E-04    .44442E-03       -.15    .013     20.00
    27     467      .1        .0    -6   -.13224E-04    .44792E-03       -.15    .013     20.00
    28     468      .1        .0    -6   -.13185E-04    .44657E-03       -.15    .013     20.00
    29     469      .2        .0    -6   -.13117E-04    .44429E-03       -.15    .013     20.00
    30     470      .2        .0    -6   -.13089E-04    .44335E-03       -.15    .013     20.00
    31     471      .2        .0    -6   -.13122E-04    .44445E-03       -.15    .013     20.00
    32     472      .3        .0    -6   -.13199E-04    .44707E-03       -.15    .013     20.00
    33     473      .3        .0    -6   -.13270E-04    .44948E-03       -.15    .013     20.00
    34     474      .3        .0    -6   -.13263E-04    .44923E-03       -.15    .013     20.00
    35     475      .4        .0    -6   -.13128E-04    .44465E-03       -.15    .013     20.00
    36     476      .4        .0    -6   -.12882E-04    .43634E-03       -.15    .013     20.00
    37     477      .4        .0    -6   -.12623E-04    .42757E-03       -.15    .012     20.00
    38     478      .4        .0    -6   -.12468E-04    .42230E-03       -.15    .012     20.00
    39     479      .5        .0    -6   -.12467E-04    .42226E-03       -.15    .013     20.00
    40     480      .5        .0    -6   -.12585E-04    .42626E-03       -.15    .013     20.00
    41     481      .5        .0    -6   -.12756E-04    .43206E-03       -.15    .013     20.00
    42     482      .6        .0    -6   -.12926E-04    .43782E-03       -.15    .013     20.00
    43     483      .6        .0    -6   -.13058E-04    .44227E-03       -.15    .013     20.00
    44     484      .6        .0    -6   -.65616E-05    .44449E-03       -.15    .013     20.00


 Time:            15.5000

     i       n       x         z     Code        Q             v            h        th       Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]              [V/T]         [L/T]         [L]      [-]       [C]     [M/L3]
[VM/T.L3]

     1       1      .0       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     2       2      .0       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     3       3      .1       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     4       4      .1       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     5       5      .1       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     6       6      .1       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     7       7      .2       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     8       8      .2       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
     9       9      .2       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    10      10      .3       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    11      11      .3       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    12      12      .3       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    13      13      .4       1.0    -4    .00000E+00    .00000E+00       -.44    .147     20.00
    14      14      .4       1.0    -4    .00000E+00    .00000E+00       -.44    .146     20.00
    15      15      .4       1.0    -4    .00000E+00    .00000E+00       -.44    .146     20.00
    16      16      .4       1.0    -4    .00000E+00    .00000E+00       -.44    .146     20.00
    17      17      .5       1.0    -4    .00000E+00    .00000E+00       -.44    .146     20.00
    18      18      .5       1.0    -4    .00000E+00    .00000E+00       -.44    .146     20.00
    19      19      .5       1.0    -4    .00000E+00    .00000E+00       -.44    .146     20.00
    20      20      .6       1.0    -4    .00000E+00    .00000E+00       -.44    .146     20.00
```

```
    21     21      .6     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    22     22      .6     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    23    463      .0      .0   -6  -.61113E-05   .41399E-03      -.15   .012      20.00
    24    464      .0      .0   -6  -.12078E-04   .40909E-03      -.15   .012      20.00
    25    465      .1      .0   -6  -.12440E-04   .42134E-03      -.15   .012      20.00
    26    466      .1      .0   -6  -.12974E-04   .43945E-03      -.15   .013      20.00
    27    467      .1      .0   -6  -.13346E-04   .45203E-03      -.15   .013      20.00
    28    468      .1      .0   -6  -.13408E-04   .45415E-03      -.15   .013      20.00
    29    469      .2      .0   -6  -.13151E-04   .44543E-03      -.15   .013      20.00
    30    470      .2      .0   -6  -.12773E-04   .43263E-03      -.15   .013      20.00
    31    471      .2      .0   -6  -.12535E-04   .42458E-03      -.15   .012      20.00
    32    472      .3      .0   -6  -.12518E-04   .42398E-03      -.15   .012      20.00
    33    473      .3      .0   -6  -.12670E-04   .42915E-03      -.15   .013      20.00
    34    474      .3      .0   -6  -.12987E-04   .43987E-03      -.15   .013      20.00
    35    475      .4      .0   -6  -.13365E-04   .45267E-03      -.15   .013      20.00
    36    476      .4      .0   -6  -.13611E-04   .46102E-03      -.15   .013      20.00
    37    477      .4      .0   -6  -.13562E-04   .45937E-03      -.15   .013      20.00
    38    478      .4      .0   -6  -.13182E-04   .44650E-03      -.15   .013      20.00
    39    479      .5      .0   -6  -.12669E-04   .42910E-03      -.15   .012      20.00
    40    480      .5      .0   -6  -.12291E-04   .41632E-03      -.15   .012      20.00
    41    481      .5      .0   -6  -.12152E-04   .41162E-03      -.15   .012      20.00
    42    482      .6      .0   -6  -.12204E-04   .41338E-03      -.15   .012      20.00
    43    483      .6      .0   -6  -.12421E-04   .42071E-03      -.15   .012      20.00
    44    484      .6      .0   -6  -.63025E-05   .42694E-03      -.15   .012      20.00


  Time:          16.0000

     i       n       x        z    Code       Q           v           h       th       Temp   Conc(1-NS)
 Qc(1-NS)
                    [L]      [L]            [V/T]       [L/T]        [L]     [-]       [C]     [M/L3]
 [VM/T.L3]

     1      1      .0     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
     2      2      .0     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
     3      3      .1     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
     4      4      .1     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
     5      5      .1     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
     6      6      .1     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
     7      7      .2     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
     8      8      .2     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
     9      9      .2     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    10     10      .3     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    11     11      .3     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    12     12      .3     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    13     13      .4     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    14     14      .4     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    15     15      .4     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    16     16      .4     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    17     17      .5     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    18     18      .5     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    19     19      .5     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    20     20      .6     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    21     21      .6     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    22     22      .6     1.0   -4   .00000E+00   .00000E+00      -.44   .146      20.00
    23    463      .0      .0   -6  -.48413E-05   .32796E-03      -.15   .012      20.00
    24    464      .0      .0   -6  -.11061E-04   .37464E-03      -.15   .012      20.00
    25    465      .1      .0   -6  -.11624E-04   .39373E-03      -.15   .012      20.00
    26    466      .1      .0   -6  -.11779E-04   .39896E-03      -.15   .012      20.00
    27    467      .1      .0   -6  -.11794E-04   .39948E-03      -.15   .012      20.00
    28    468      .1      .0   -6  -.11762E-04   .39838E-03      -.15   .012      20.00
    29    469      .2      .0   -6  -.11743E-04   .39775E-03      -.15   .012      20.00
    30    470      .2      .0   -6  -.11784E-04   .39914E-03      -.15   .012      20.00
    31    471      .2      .0   -6  -.11866E-04   .40193E-03      -.15   .012      20.00
    32    472      .3      .0   -6  -.11941E-04   .40443E-03      -.15   .012      20.00
    33    473      .3      .0   -6  -.11988E-04   .40603E-03      -.15   .012      20.00
    34    474      .3      .0   -6  -.11990E-04   .40611E-03      -.15   .012      20.00
    35    475      .4      .0   -6  -.11923E-04   .40384E-03      -.15   .012      20.00
    36    476      .4      .0   -6  -.11794E-04   .39949E-03      -.15   .012      20.00
    37    477      .4      .0   -6  -.11644E-04   .39439E-03      -.15   .012      20.00
    38    478      .4      .0   -6  -.11531E-04   .39055E-03      -.15   .012      20.00
    39    479      .5      .0   -6  -.11517E-04   .39008E-03      -.15   .012      20.00
    40    480      .5      .0   -6  -.11589E-04   .39252E-03      -.15   .012      20.00
    41    481      .5      .0   -6  -.11691E-04   .39600E-03      -.15   .012      20.00
    42    482      .6      .0   -6  -.11794E-04   .39949E-03      -.15   .012      20.00
    43    483      .6      .0   -6  -.11867E-04   .40196E-03      -.15   .012      20.00
    44    484      .6      .0   -6  -.59605E-05   .40377E-03      -.15   .012      20.00
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 Time:           16.5000

    i      n      x        z    Code       Q            v           h        th      Temp  Conc(1-NS)
Qc(1-NS)
                 [L]      [L]            [V/T]        [L/T]        [L]      [-]       [C]    [M/L3]
[VM/T.L3]

   1      1       .0      1.0   -4   .00000E+00   .00000E+00       -.44   .146     20.00
   2      2       .0      1.0   -4   .00000E+00   .00000E+00       -.44   .146     20.00
   3      3       .1      1.0   -4   .00000E+00   .00000E+00       -.44   .146     20.00
   4      4       .1      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   5      5       .1      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   6      6       .1      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   7      7       .2      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   8      8       .2      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   9      9       .2      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  10     10       .3      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  11     11       .3      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  12     12       .3      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  13     13       .4      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  14     14       .4      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  15     15       .4      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  16     16       .4      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  17     17       .5      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  18     18       .5      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  19     19       .5      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  20     20       .6      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  21     21       .6      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  22     22       .6      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  23    463       .0       .0   -6  -.53610E-05   .36316E-03       -.15   .012     20.00
  24    464       .0       .0   -6  -.10985E-04   .37208E-03       -.15   .012     20.00
  25    465       .1       .0   -6  -.10966E-04   .37144E-03       -.15   .012     20.00
  26    466       .1       .0   -6  -.10883E-04   .36862E-03       -.15   .012     20.00
  27    467       .1       .0   -6  -.10857E-04   .36775E-03       -.15   .012     20.00
  28    468       .1       .0   -6  -.10928E-04   .37015E-03       -.15   .012     20.00
  29    469       .2       .0   -6  -.10966E-04   .37141E-03       -.15   .012     20.00
  30    470       .2       .0   -6  -.10953E-04   .37101E-03       -.15   .012     20.00
  31    471       .2       .0   -6  -.10934E-04   .37035E-03       -.15   .012     20.00
  32    472       .3       .0   -6  -.10941E-04   .37060E-03       -.15   .012     20.00
  33    473       .3       .0   -6  -.10933E-04   .37032E-03       -.15   .012     20.00
  34    474       .3       .0   -6  -.10906E-04   .36939E-03       -.15   .012     20.00
  35    475       .4       .0   -6  -.10919E-04   .36984E-03       -.15   .012     20.00
  36    476       .4       .0   -6  -.11005E-04   .37276E-03       -.15   .012     20.00
  37    477       .4       .0   -6  -.11076E-04   .37514E-03       -.15   .012     20.00
  38    478       .4       .0   -6  -.11119E-04   .37660E-03       -.15   .012     20.00
  39    479       .5       .0   -6  -.11212E-04   .37977E-03       -.15   .012     20.00
  40    480       .5       .0   -6  -.11250E-04   .38103E-03       -.15   .012     20.00
  41    481       .5       .0   -6  -.11249E-04   .38101E-03       -.15   .012     20.00
  42    482       .6       .0   -6  -.11278E-04   .38201E-03       -.15   .012     20.00
  43    483       .6       .0   -6  -.11323E-04   .38351E-03       -.15   .012     20.00
  44    484       .6       .0   -6  -.56849E-05   .38511E-03       -.15   .012     20.00


 Time:           17.0000

    i      n      x        z    Code       Q            v           h        th      Temp  Conc(1-NS)
Qc(1-NS)
                 [L]      [L]            [V/T]        [L/T]        [L]      [-]       [C]    [M/L3]
[VM/T.L3]

   1      1       .0      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   2      2       .0      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   3      3       .1      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   4      4       .1      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   5      5       .1      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   6      6       .1      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   7      7       .2      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   8      8       .2      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
   9      9       .2      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  10     10       .3      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  11     11       .3      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  12     12       .3      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  13     13       .4      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  14     14       .4      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  15     15       .4      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  16     16       .4      1.0   -4   .00000E+00   .00000E+00       -.44   .145     20.00
  17     17       .5      1.0   -4   .00000E+00   .00000E+00       -.44   .145
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    18     18       .5      1.0   -4   .00000E+00   .00000E+00       -.44   .145      20.00
    19     19       .5      1.0   -4   .00000E+00   .00000E+00       -.44   .145      20.00
    20     20       .6      1.0   -4   .00000E+00   .00000E+00       -.44   .145      20.00
    21     21       .6      1.0   -4   .00000E+00   .00000E+00       -.44   .145      20.00
    22     22       .6      1.0   -4   .00000E+00   .00000E+00       -.44   .145      20.00
    23    463       .0       .0   -6  -.61400E-05   .41593E-03       -.15   .012      20.00
    24    464       .0       .0   -6  -.11891E-04   .40278E-03       -.15   .012      20.00
    25    465       .1       .0   -6  -.11208E-04   .37961E-03       -.15   .012      20.00
    26    466       .1       .0   -6  -.11250E-04   .38104E-03       -.15   .012      20.00
    27    467       .1       .0   -6  -.11411E-04   .38651E-03       -.15   .012      20.00
    28    468       .1       .0   -6  -.11449E-04   .38779E-03       -.15   .012      20.00
    29    469       .2       .0   -6  -.11342E-04   .38417E-03       -.15   .012      20.00
    30    470       .2       .0   -6  -.11176E-04   .37856E-03       -.15   .012      20.00
    31    471       .2       .0   -6  -.10995E-04   .37243E-03       -.15   .012      20.00
    32    472       .3       .0   -6  -.10830E-04   .36683E-03       -.15   .012      20.00
    33    473       .3       .0   -6  -.10650E-04   .36072E-03       -.15   .012      20.00
    34    474       .3       .0   -6  -.10620E-04   .35972E-03       -.15   .012      20.00
    35    475       .4       .0   -6  -.10684E-04   .36187E-03       -.15   .012      20.00
    36    476       .4       .0   -6  -.10591E-04   .35874E-03       -.15   .012      20.00
    37    477       .4       .0   -6  -.10575E-04   .35818E-03       -.15   .012      20.00
    38    478       .4       .0   -6  -.10723E-04   .36318E-03       -.15   .012      20.00
    39    479       .5       .0   -6  -.10550E-04   .35733E-03       -.15   .012      20.00
    40    480       .5       .0   -6  -.10316E-04   .34941E-03       -.15   .012      20.00
    41    481       .5       .0   -6  -.10119E-04   .34274E-03       -.15   .012      20.00
    42    482       .6       .0   -6  -.99458E-05   .33688E-03       -.15   .012      20.00
    43    483       .6       .0   -6  -.98272E-05   .33286E-03       -.15   .012      20.00
    44    484       .6       .0   -6  -.49200E-05   .33329E-03       -.15   .012      20.00


 Time:           17.5000

     i       n       x        z    Code       Q            v            h        th        Temp   Conc(1-NS)
Qc(1-NS)
                    [L]      [L]            [V/T]        [L/T]         [L]       [-]        [C]     [M/L3]
[VM/T.L3]

     1      1       .0      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
     2      2       .0      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
     3      3       .1      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
     4      4       .1      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
     5      5       .1      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
     6      6       .1      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
     7      7       .2      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
     8      8       .2      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
     9      9       .2      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    10     10       .3      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    11     11       .3      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    12     12       .3      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    13     13       .4      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    14     14       .4      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    15     15       .4      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    16     16       .4      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    17     17       .5      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    18     18       .5      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    19     19       .5      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    20     20       .6      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    21     21       .6      1.0   -4   .00000E+00   .00000E+00       -.45   .145      20.00
    22     22       .6      1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
    23    463       .0       .0   -6  -.47311E-05   .32049E-03       -.15   .012      20.00
    24    464       .0       .0   -6  -.96639E-05   .32733E-03       -.15   .012      20.00
    25    465       .1       .0   -6  -.11047E-04   .37418E-03       -.15   .012      20.00
    26    466       .1       .0   -6  -.11547E-04   .39111E-03       -.15   .012      20.00
    27    467       .1       .0   -6  -.11507E-04   .38976E-03       -.15   .012      20.00
    28    468       .1       .0   -6  -.11284E-04   .38220E-03       -.15   .012      20.00
    29    469       .2       .0   -6  -.11073E-04   .37504E-03       -.15   .012      20.00
    30    470       .2       .0   -6  -.10974E-04   .37170E-03       -.15   .012      20.00
    31    471       .2       .0   -6  -.11008E-04   .37287E-03       -.15   .012      20.00
    32    472       .3       .0   -6  -.11150E-04   .37766E-03       -.15   .012      20.00
    33    473       .3       .0   -6  -.11328E-04   .38367E-03       -.15   .012      20.00
    34    474       .3       .0   -6  -.11376E-04   .38533E-03       -.15   .012      20.00
    35    475       .4       .0   -6  -.11245E-04   .38089E-03       -.15   .012      20.00
    36    476       .4       .0   -6  -.10940E-04   .37056E-03       -.15   .012      20.00
    37    477       .4       .0   -6  -.10497E-04   .35554E-03       -.15   .012      20.00
    38    478       .4       .0   -6  -.10061E-04   .34079E-03       -.15   .012      20.00
    39    479       .5       .0   -6  -.97447E-05   .33006E-03       -.15   .012      20.00
    40    480       .5       .0   -6  -.97275E-05   .32948E-03       -.15   .012      20.00
    41    481       .5       .0   -6  -.97281E-05   .32950E-03       -.15   .012      20.00
    42    482       .6       .0   -6  -.97299E-05   .32956E-03       -.15   .012      20.00
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    43    483      .6      .0    -6  -.97302E-05   .32957E-03        -.15   .012      20.00
    44    484      .6      .0    -6  -.48627E-05   .32941E-03        -.15   .012      20.00


 Time:          18.0000

     i       n       x         z     Code        Q             v            h         th        Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]              [V/T]         [L/T]          [L]       [-]        [C]      [M/L3]
[VM/T.L3]

     1       1      .0      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     2       2      .0      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     3       3      .1      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     4       4      .1      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     5       5      .1      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     6       6      .1      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     7       7      .2      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     8       8      .2      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     9       9      .2      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    10      10      .3      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    11      11      .3      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    12      12      .3      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    13      13      .4      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    14      14      .4      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    15      15      .4      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    16      16      .4      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    17      17      .5      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    18      18      .5      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    19      19      .5      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    20      20      .6      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    21      21      .6      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    22      22      .6      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    23     463      .0       .0    -6  -.48171E-05   .32632E-03        -.15   .012      20.00
    24     464      .0       .0    -6  -.96253E-05   .32602E-03        -.15   .012      20.00
    25     465      .1       .0    -6  -.95297E-05   .32278E-03        -.15   .012      20.00
    26     466      .1       .0    -6  -.95057E-05   .32197E-03        -.15   .012      20.00
    27     467      .1       .0    -6  -.95125E-05   .32220E-03        -.15   .012      20.00
    28     468      .1       .0    -6  -.95248E-05   .32261E-03        -.15   .012      20.00
    29     469      .2       .0    -6  -.95343E-05   .32293E-03        -.15   .012      20.00
    30     470      .2       .0    -6  -.95376E-05   .32305E-03        -.15   .012      20.00
    31     471      .2       .0    -6  -.95311E-05   .32283E-03        -.15   .012      20.00
    32     472      .3       .0    -6  -.95188E-05   .32241E-03        -.15   .012      20.00
    33     473      .3       .0    -6  -.95163E-05   .32232E-03        -.15   .012      20.00
    34     474      .3       .0    -6  -.95333E-05   .32290E-03        -.15   .012      20.00
    35     475      .4       .0    -6  -.95677E-05   .32406E-03        -.15   .012      20.00
    36     476      .4       .0    -6  -.96094E-05   .32548E-03        -.15   .012      20.00
    37     477      .4       .0    -6  -.96438E-05   .32665E-03        -.15   .012      20.00
    38     478      .4       .0    -6  -.96704E-05   .32754E-03        -.15   .012      20.00
    39     479      .5       .0    -6  -.96880E-05   .32814E-03        -.15   .012      20.00
    40     480      .5       .0    -6  -.97004E-05   .32856E-03        -.15   .012      20.00
    41     481      .5       .0    -6  -.97061E-05   .32876E-03        -.15   .012      20.00
    42     482      .6       .0    -6  -.97093E-05   .32887E-03        -.15   .012      20.00
    43     483      .6       .0    -6  -.97125E-05   .32897E-03        -.15   .012      20.00
    44     484      .6       .0    -6  -.48574E-05   .32905E-03        -.15   .012      20.00


 Time:          18.5000

     i       n       x         z     Code        Q             v            h         th        Temp   Conc(1-NS)
Qc(1-NS)
                    [L]       [L]              [V/T]         [L/T]          [L]       [-]        [C]      [M/L3]
[VM/T.L3]

     1       1      .0      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     2       2      .0      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     3       3      .1      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     4       4      .1      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     5       5      .1      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     6       6      .1      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     7       7      .2      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     8       8      .2      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
     9       9      .2      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    10      10      .3      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    11      11      .3      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    12      12      .3      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    13      13      .4      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
    14      14      .4      1.0    -4   .00000E+00   .00000E+00        -.45   .144      20.00
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   15     15       .4       1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
   16     16       .4       1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
   17     17       .5       1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
   18     18       .5       1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
   19     19       .5       1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
   20     20       .6       1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
   21     21       .6       1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
   22     22       .6       1.0   -4   .00000E+00   .00000E+00       -.45   .144      20.00
   23    463       .0        .0   -6  -.48116E-05   .32595E-03       -.15   .012      20.00
   24    464       .0        .0   -6  -.96164E-05   .32572E-03       -.15   .012      20.00
   25    465       .1        .0   -6  -.95913E-05   .32487E-03       -.15   .012      20.00
   26    466       .1        .0   -6  -.95757E-05   .32434E-03       -.15   .012      20.00
   27    467       .1        .0   -6  -.95711E-05   .32418E-03       -.15   .012      20.00
   28    468       .1        .0   -6  -.95733E-05   .32426E-03       -.15   .012      20.00
   29    469       .2        .0   -6  -.95785E-05   .32443E-03       -.15   .012      20.00
   30    470       .2        .0   -6  -.95838E-05   .32461E-03       -.15   .012      20.00
   31    471       .2        .0   -6  -.95882E-05   .32477E-03       -.15   .012      20.00
   32    472       .3        .0   -6  -.95928E-05   .32491E-03       -.15   .012      20.00
   33    473       .3        .0   -6  -.95988E-05   .32512E-03       -.15   .012      20.00
   34    474       .3        .0   -6  -.96077E-05   .32542E-03       -.15   .012      20.00
   35    475       .4        .0   -6  -.96203E-05   .32585E-03       -.15   .012      20.00
   36    476       .4        .0   -6  -.96360E-05   .32638E-03       -.15   .012      20.00
   37    477       .4        .0   -6  -.96532E-05   .32697E-03       -.15   .012      20.00
   38    478       .4        .0   -6  -.96696E-05   .32752E-03       -.15   .012      20.00
   39    479       .5        .0   -6  -.96832E-05   .32798E-03       -.15   .012      20.00
   40    480       .5        .0   -6  -.96934E-05   .32832E-03       -.15   .012      20.00
   41    481       .5        .0   -6  -.96999E-05   .32855E-03       -.15   .012      20.00
   42    482       .6        .0   -6  -.97041E-05   .32869E-03       -.15   .012      20.00
   43    483       .6        .0   -6  -.97071E-05   .32879E-03       -.15   .012      20.00
   44    484       .6        .0   -6  -.48543E-05   .32884E-03       -.15   .012      20.00


 Time:          19.0000

    i       n       x          z    Code       Q             v             h         th       Temp    Conc(1-NS)
Qc(1-NS)
                   [L]        [L]            [V/T]         [L/T]          [L]        [-]       [C]      [M/L3]

[VM/T.L3]

    1      1       .0       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
    2      2       .0       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
    3      3       .1       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
    4      4       .1       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
    5      5       .1       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
    6      6       .1       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
    7      7       .2       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
    8      8       .2       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
    9      9       .2       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   10     10       .3       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   11     11       .3       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   12     12       .3       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   13     13       .4       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   14     14       .4       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   15     15       .4       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   16     16       .4       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   17     17       .5       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   18     18       .5       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   19     19       .5       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   20     20       .6       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   21     21       .6       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   22     22       .6       1.0   -4   .00000E+00   .00000E+00       -.45   .143      20.00
   23    463       .0        .0   -6  -.48151E-05   .32619E-03       -.15   .012      20.00
   24    464       .0        .0   -6  -.96275E-05   .32609E-03       -.15   .012      20.00
   25    465       .1        .0   -6  -.96229E-05   .32594E-03       -.15   .012      20.00
   26    466       .1        .0   -6  -.96172E-05   .32574E-03       -.15   .012      20.00
   27    467       .1        .0   -6  -.96133E-05   .32561E-03       -.15   .012      20.00
   28    468       .1        .0   -6  -.96132E-05   .32561E-03       -.15   .012      20.00
   29    469       .2        .0   -6  -.96167E-05   .32573E-03       -.15   .012      20.00
   30    470       .2        .0   -6  -.96227E-05   .32593E-03       -.15   .012      20.00
   31    471       .2        .0   -6  -.96304E-05   .32619E-03       -.15   .012      20.00
   32    472       .3        .0   -6  -.96382E-05   .32645E-03       -.15   .012      20.00
   33    473       .3        .0   -6  -.96442E-05   .32666E-03       -.15   .012      20.00
   34    474       .3        .0   -6  -.96482E-05   .32679E-03       -.15   .012      20.00
   35    475       .4        .0   -6  -.96519E-05   .32692E-03       -.15   .012      20.00
   36    476       .4        .0   -6  -.96572E-05   .32710E-03       -.15   .012      20.00
   37    477       .4        .0   -6  -.96654E-05   .32738E-03       -.15   .012      20.00
   38    478       .4        .0   -6  -.96754E-05   .32771E-03       -.15   .012      20.00
   39    479       .5        .0   -6  -.96850E-05   .32804E-03       -.15   .012      20.00
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    40    480      .5      .0   -6  -.96930E-05   .32831E-03      -.15   .012     20.00
    41    481      .5      .0   -6  -.96987E-05   .32851E-03      -.15   .012     20.00
    42    482      .6      .0   -6  -.97026E-05   .32864E-03      -.15   .012     20.00
    43    483      .6      .0   -6  -.97051E-05   .32872E-03      -.15   .012     20.00
    44    484      .6      .0   -6  -.48530E-05   .32875E-03      -.15   .012     20.00

  Time:          19.5000

     i       n       x        z     Code        Q            v            h        th       Temp   Conc(1-NS)
 Qc(1-NS)
                    [L]      [L]              [V/T]        [L/T]         [L]      [-]       [C]     [M/L3]
 [VM/T.L3]

     1       1      .0      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
     2       2      .0      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
     3       3      .1      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
     4       4      .1      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
     5       5      .1      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
     6       6      .1      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
     7       7      .2      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
     8       8      .2      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
     9       9      .2      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    10      10      .3      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    11      11      .3      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    12      12      .3      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    13      13      .4      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    14      14      .4      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    15      15      .4      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    16      16      .4      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    17      17      .5      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    18      18      .5      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    19      19      .5      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    20      20      .6      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    21      21      .6      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    22      22      .6      1.0   -4   .00000E+00   .00000E+00      -.45   .143     20.00
    23     463      .0       .0   -6  -.48060E-05   .32556E-03      -.15   .012     20.00
    24     464      .0       .0   -6  -.96120E-05   .32557E-03      -.15   .012     20.00
    25     465      .1       .0   -6  -.96085E-05   .32545E-03      -.15   .012     20.00
    26     466      .1       .0   -6  -.96051E-05   .32533E-03      -.15   .012     20.00
    27     467      .1       .0   -6  -.96035E-05   .32528E-03      -.15   .012     20.00
    28     468      .1       .0   -6  -.96045E-05   .32531E-03      -.15   .012     20.00
    29     469      .2       .0   -6  -.96073E-05   .32541E-03      -.15   .012     20.00
    30     470      .2       .0   -6  -.96113E-05   .32555E-03      -.15   .012     20.00
    31     471      .2       .0   -6  -.96162E-05   .32571E-03      -.15   .012     20.00
    32     472      .3       .0   -6  -.96217E-05   .32589E-03      -.15   .012     20.00
    33     473      .3       .0   -6  -.96274E-05   .32609E-03      -.15   .012     20.00
    34     474      .3       .0   -6  -.96340E-05   .32631E-03      -.15   .012     20.00
    35     475      .4       .0   -6  -.96418E-05   .32657E-03      -.15   .012     20.00
    36     476      .4       .0   -6  -.96508E-05   .32689E-03      -.15   .012     20.00
    37     477      .4       .0   -6  -.96613E-05   .32724E-03      -.15   .012     20.00
    38     478      .4       .0   -6  -.96721E-05   .32760E-03      -.15   .012     20.00
    39     479      .5       .0   -6  -.96819E-05   .32793E-03      -.15   .012     20.00
    40     480      .5       .0   -6  -.96900E-05   .32821E-03      -.15   .012     20.00
    41     481      .5       .0   -6  -.96958E-05   .32841E-03      -.15   .012     20.00
    42     482      .6       .0   -6  -.96999E-05   .32855E-03      -.15   .012     20.00
    43     483      .6       .0   -6  -.97025E-05   .32863E-03      -.15   .012     20.00
    44     484      .6       .0   -6  -.48517E-05   .32866E-03      -.15   .012     20.00

  Time:          20.0000

     i       n       x        z     Code        Q            v            h        th       Temp   Conc(1-NS)
 Qc(1-NS)
                    [L]      [L]              [V/T]        [L/T]         [L]      [-]       [C]     [M/L3]
 [VM/T.L3]

     1       1      .0      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
     2       2      .0      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
     3       3      .1      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
     4       4      .1      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
     5       5      .1      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
     6       6      .1      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
     7       7      .2      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
     8       8      .2      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
     9       9      .2      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
    10      10      .3      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
    11      11      .3      1.0   -4   .00000E+00   .00000E+00      -.46   .143     20.00
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    12     12      .3     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    13     13      .4     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    14     14      .4     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    15     15      .4     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    16     16      .4     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    17     17      .5     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    18     18      .5     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    19     19      .5     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    20     20      .6     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    21     21      .6     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    22     22      .6     1.0   -4   .00000E+00   .00000E+00        -.46   .143     20.00
    23    463      .0      .0   -6  -.48136E-05   .32608E-03        -.15   .012     20.00
    24    464      .0      .0   -6  -.96257E-05   .32603E-03        -.15   .012     20.00
    25    465      .1      .0   -6  -.96250E-05   .32601E-03        -.15   .012     20.00
    26    466      .1      .0   -6  -.96242E-05   .32598E-03        -.15   .012     20.00
    27    467      .1      .0   -6  -.96241E-05   .32598E-03        -.15   .012     20.00
    28    468      .1      .0   -6  -.96251E-05   .32601E-03        -.15   .012     20.00
    29    469      .2      .0   -6  -.96275E-05   .32609E-03        -.15   .012     20.00
    30    470      .2      .0   -6  -.96311E-05   .32622E-03        -.15   .012     20.00
    31    471      .2      .0   -6  -.96358E-05   .32638E-03        -.15   .012     20.00
    32    472      .3      .0   -6  -.96410E-05   .32655E-03        -.15   .012     20.00
    33    473      .3      .0   -6  -.96462E-05   .32672E-03        -.15   .012     20.00
    34    474      .3      .0   -6  -.96513E-05   .32690E-03        -.15   .012     20.00
    35    475      .4      .0   -6  -.96569E-05   .32709E-03        -.15   .012     20.00
    36    476      .4      .0   -6  -.96632E-05   .32731E-03        -.15   .012     20.00
    37    477      .4      .0   -6  -.96705E-05   .32755E-03        -.15   .012     20.00
    38    478      .4      .0   -6  -.96784E-05   .32781E-03        -.15   .012     20.00
    39    479      .5      .0   -6  -.96857E-05   .32806E-03        -.15   .012     20.00
    40    480      .5      .0   -6  -.96919E-05   .32827E-03        -.15   .012     20.00
    41    481      .5      .0   -6  -.96965E-05   .32843E-03        -.15   .012     20.00
    42    482      .6      .0   -6  -.96998E-05   .32855E-03        -.15   .012     20.00
    43    483      .6      .0   -6  -.97020E-05   .32861E-03        -.15   .012     20.00
    44    484      .6      .0   -6  -.48513E-05   .32864E-03        -.15   .012     20.00


  Time:            20.5000

      i       n        x        z     Code       Q            v            h        th        Temp   Conc(1-NS)
 Qc(1-NS)
                     [L]      [L]               [V/T]        [L/T]        [L]      [-]        [C]     [M/L3]

 [VM/T.L3]

     1      1      .0     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
     2      2      .0     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
     3      3      .1     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
     4      4      .1     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
     5      5      .1     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
     6      6      .1     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
     7      7      .2     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
     8      8      .2     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
     9      9      .2     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    10     10      .3     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    11     11      .3     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    12     12      .3     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    13     13      .4     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    14     14      .4     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    15     15      .4     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    16     16      .4     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    17     17      .5     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    18     18      .5     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    19     19      .5     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    20     20      .6     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    21     21      .6     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    22     22      .6     1.0   -4   .00000E+00   .00000E+00        -.46   .142     20.00
    23    463      .0      .0   -6  -.48102E-05   .32585E-03        -.15   .012     20.00
    24    464      .0      .0   -6  -.96210E-05   .32587E-03        -.15   .012     20.00
    25    465      .1      .0   -6  -.96207E-05   .32586E-03        -.15   .012     20.00
    26    466      .1      .0   -6  -.96204E-05   .32585E-03        -.15   .012     20.00
    27    467      .1      .0   -6  -.96207E-05   .32586E-03        -.15   .012     20.00
    28    468      .1      .0   -6  -.96220E-05   .32590E-03        -.15   .012     20.00
    29    469      .2      .0   -6  -.96240E-05   .32597E-03        -.15   .012     20.00
    30    470      .2      .0   -6  -.96265E-05   .32606E-03        -.15   .012     20.00
    31    471      .2      .0   -6  -.96300E-05   .32618E-03        -.15   .012     20.00
    32    472      .3      .0   -6  -.96345E-05   .32633E-03        -.15   .012     20.00
    33    473      .3      .0   -6  -.96397E-05   .32650E-03        -.15   .012     20.00
    34    474      .3      .0   -6  -.96460E-05   .32672E-03        -.15   .012     20.00
    35    475      .4      .0   -6  -.96532E-05   .32696E-03        -.15   .012     20.00
    36    476      .4      .0   -6  -.96611E-05   .32723E-03        -.15   .012     20.00
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    37    477      .4      .0   -6  -.96693E-05  .32751E-03      -.15   .012     20.00
    38    478      .4      .0   -6  -.96775E-05  .32778E-03      -.15   .012     20.00
    39    479      .5      .0   -6  -.96847E-05  .32803E-03      -.15   .012     20.00
    40    480      .5      .0   -6  -.96907E-05  .32823E-03      -.15   .012     20.00
    41    481      .5      .0   -6  -.96951E-05  .32839E-03      -.15   .012     20.00
    42    482      .6      .0   -6  -.96983E-05  .32850E-03      -.15   .012     20.00
    43    483      .6      .0   -6  -.97005E-05  .32856E-03      -.15   .012     20.00
    44    484      .6      .0   -6  -.48506E-05  .32859E-03      -.15   .012     20.00


 Time:           21.0000

     i       n       x        z    Code       Q           v           h       th       Temp   Conc(1-NS)
Qc(1-NS)
                    [L]      [L]            [V/T]       [L/T]        [L]     [-]       [C]     [M/L3]
[VM/T.L3]

     1       1      .0     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     2       2      .0     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     3       3      .1     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     4       4      .1     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     5       5      .1     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     6       6      .1     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     7       7      .2     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     8       8      .2     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     9       9      .2     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    10      10      .3     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    11      11      .3     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    12      12      .3     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    13      13      .4     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    14      14      .4     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    15      15      .4     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    16      16      .4     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    17      17      .5     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    18      18      .5     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    19      19      .5     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    20      20      .6     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    21      21      .6     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    22      22      .6     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
    23     463      .0      .0   -6  -.48178E-05  .32637E-03      -.15   .012     20.00
    24     464      .0      .0   -6  -.96346E-05  .32633E-03      -.15   .012     20.00
    25     465      .1      .0   -6  -.96345E-05  .32633E-03      -.15   .012     20.00
    26     466      .1      .0   -6  -.96349E-05  .32635E-03      -.15   .012     20.00
    27     467      .1      .0   -6  -.96357E-05  .32637E-03      -.15   .012     20.00
    28     468      .1      .0   -6  -.96371E-05  .32641E-03      -.15   .012     20.00
    29     469      .2      .0   -6  -.96390E-05  .32648E-03      -.15   .012     20.00
    30     470      .2      .0   -6  -.96415E-05  .32657E-03      -.15   .012     20.00
    31     471      .2      .0   -6  -.96449E-05  .32668E-03      -.15   .012     20.00
    32     472      .3      .0   -6  -.96490E-05  .32682E-03      -.15   .012     20.00
    33     473      .3      .0   -6  -.96536E-05  .32697E-03      -.15   .012     20.00
    34     474      .3      .0   -6  -.96586E-05  .32714E-03      -.15   .012     20.00
    35     475      .4      .0   -6  -.96641E-05  .32733E-03      -.15   .012     20.00
    36     476      .4      .0   -6  -.96699E-05  .32753E-03      -.15   .012     20.00
    37     477      .4      .0   -6  -.96759E-05  .32774E-03      -.15   .012     20.00
    38     478      .4      .0   -6  -.96821E-05  .32794E-03      -.15   .012     20.00
    39     479      .5      .0   -6  -.96875E-05  .32812E-03      -.15   .012     20.00
    40     480      .5      .0   -6  -.96922E-05  .32828E-03      -.15   .012     20.00
    41     481      .5      .0   -6  -.96957E-05  .32841E-03      -.15   .012     20.00
    42     482      .6      .0   -6  -.96984E-05  .32850E-03      -.15   .012     20.00
    43     483      .6      .0   -6  -.97001E-05  .32855E-03      -.15   .012     20.00
    44     484      .6      .0   -6  -.48503E-05  .32857E-03      -.15   .012     20.00


 Time:           21.5000

     i       n       x        z    Code       Q           v           h       th       Temp   Conc(1-NS)
Qc(1-NS)
                    [L]      [L]            [V/T]       [L/T]        [L]     [-]       [C]     [M/L3]
[VM/T.L3]

     1       1      .0     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     2       2      .0     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     3       3      .1     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     4       4      .1     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     5       5      .1     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     6       6      .1     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     7       7      .2     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
     8       8      .2     1.0   -4   .00000E+00  .00000E+00      -.46   .142     20.00
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     9      9       .2       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    10     10       .3       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    11     11       .3       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    12     12       .3       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    13     13       .4       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    14     14       .4       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    15     15       .4       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    16     16       .4       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    17     17       .5       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    18     18       .5       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    19     19       .5       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    20     20       .6       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    21     21       .6       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    22     22       .6       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    23    463       .0        .0   -6  -.48175E-05   .32635E-03        -.15   .012      20.00
    24    464       .0        .0   -6  -.96355E-05   .32636E-03        -.15   .012      20.00
    25    465       .1        .0   -6  -.96359E-05   .32638E-03        -.15   .012      20.00
    26    466       .1        .0   -6  -.96364E-05   .32640E-03        -.15   .012      20.00
    27    467       .1        .0   -6  -.96372E-05   .32642E-03        -.15   .012      20.00
    28    468       .1        .0   -6  -.96385E-05   .32646E-03        -.15   .012      20.00
    29    469       .2        .0   -6  -.96402E-05   .32652E-03        -.15   .012      20.00
    30    470       .2        .0   -6  -.96423E-05   .32660E-03        -.15   .012      20.00
    31    471       .2        .0   -6  -.96452E-05   .32670E-03        -.15   .012      20.00
    32    472       .3        .0   -6  -.96490E-05   .32682E-03        -.15   .012      20.00
    33    473       .3        .0   -6  -.96533E-05   .32697E-03        -.15   .012      20.00
    34    474       .3        .0   -6  -.96585E-05   .32714E-03        -.15   .012      20.00
    35    475       .4        .0   -6  -.96642E-05   .32733E-03        -.15   .012      20.00
    36    476       .4        .0   -6  -.96701E-05   .32754E-03        -.15   .012      20.00
    37    477       .4        .0   -6  -.96762E-05   .32775E-03        -.15   .012      20.00
    38    478       .4        .0   -6  -.96821E-05   .32794E-03        -.15   .012      20.00
    39    479       .5        .0   -6  -.96873E-05   .32812E-03        -.15   .012      20.00
    40    480       .5        .0   -6  -.96917E-05   .32827E-03        -.15   .012      20.00
    41    481       .5        .0   -6  -.96950E-05   .32838E-03        -.15   .012      20.00
    42    482       .6        .0   -6  -.96975E-05   .32847E-03        -.15   .012      20.00
    43    483       .6        .0   -6  -.96992E-05   .32852E-03        -.15   .012      20.00
    44    484       .6        .0   -6  -.48499E-05   .32854E-03        -.15   .012      20.00


  Time:            22.0000

     i      n       x        z     Code        Q             v             h        th        Temp   Conc(1-NS)
 Qc(1-NS)
                   [L]      [L]               [V/T]        [L/T]          [L]      [-]        [C]      [M/L3]
 [VM/T.L3]

     1      1       .0       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
     2      2       .0       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
     3      3       .1       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
     4      4       .1       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
     5      5       .1       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
     6      6       .1       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
     7      7       .2       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
     8      8       .2       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
     9      9       .2       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    10     10       .3       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    11     11       .3       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    12     12       .3       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    13     13       .4       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    14     14       .4       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    15     15       .4       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    16     16       .4       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    17     17       .5       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    18     18       .5       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    19     19       .5       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    20     20       .6       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    21     21       .6       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    22     22       .6       1.0   -4   .00000E+00   .00000E+00        -.46   .142      20.00
    23    463       .0        .0   -6  -.48237E-05   .32677E-03        -.15   .012      20.00
    24    464       .0        .0   -6  -.96467E-05   .32674E-03        -.15   .012      20.00
    25    465       .1        .0   -6  -.96468E-05   .32675E-03        -.15   .012      20.00
    26    466       .1        .0   -6  -.96474E-05   .32677E-03        -.15   .012      20.00
    27    467       .1        .0   -6  -.96483E-05   .32680E-03        -.15   .012      20.00
    28    468       .1        .0   -6  -.96496E-05   .32684E-03        -.15   .012      20.00
    29    469       .2        .0   -6  -.96513E-05   .32690E-03        -.15   .012      20.00
    30    470       .2        .0   -6  -.96533E-05   .32697E-03        -.15   .012      20.00
    31    471       .2        .0   -6  -.96560E-05   .32706E-03        -.15   .012      20.00
    32    472       .3        .0   -6  -.96594E-05   .32717E-03        -.15   .012      20.00
    33    473       .3        .0   -6  -.96630E-05   .32729E-03        -.15   .012      20.00
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     34    474       .3       .0    -6  -.96671E-05   .32743E-03       -.15   .012     20.00
     35    475       .4       .0    -6  -.96716E-05   .32758E-03       -.15   .012     20.00
     36    476       .4       .0    -6  -.96760E-05   .32774E-03       -.15   .012     20.00
     37    477       .4       .0    -6  -.96806E-05   .32790E-03       -.15   .012     20.00
     38    478       .4       .0    -6  -.96852E-05   .32804E-03       -.15   .012     20.00
     39    479       .5       .0    -6  -.96892E-05   .32818E-03       -.15   .012     20.00
     40    480       .5       .0    -6  -.96927E-05   .32830E-03       -.15   .012     20.00
     41    481       .5       .0    -6  -.96954E-05   .32839E-03       -.15   .012     20.00
     42    482       .6       .0    -6  -.96974E-05   .32846E-03       -.15   .012     20.00
     43    483       .6       .0    -6  -.96988E-05   .32851E-03       -.15   .012     20.00
     44    484       .6       .0    -6  -.48496E-05   .32852E-03       -.15   .012     20.00


  Time:            22.5000

      i       n       x        z    Code       Q            v             h        th       Temp   Conc(1-NS)
 Qc(1-NS)
                    [L]      [L]            [V/T]         [L/T]          [L]      [-]       [C]     [M/L3]
 [VM/T.L3]

      1       1      .0      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      2       2      .0      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      3       3      .1      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      4       4      .1      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      5       5      .1      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      6       6      .1      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      7       7      .2      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      8       8      .2      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      9       9      .2      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     10      10      .3      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     11      11      .3      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     12      12      .3      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     13      13      .4      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     14      14      .4      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     15      15      .4      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     16      16      .4      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     17      17      .5      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     18      18      .5      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     19      19      .5      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     20      20      .6      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     21      21      .6      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     22      22      .6      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
     23     463      .0       .0    -6  -.48246E-05   .32683E-03       -.15   .012     20.00
     24     464      .0       .0    -6  -.96494E-05   .32684E-03       -.15   .012     20.00
     25     465      .1       .0    -6  -.96499E-05   .32685E-03       -.15   .012     20.00
     26     466      .1       .0    -6  -.96505E-05   .32687E-03       -.15   .012     20.00
     27     467      .1       .0    -6  -.96513E-05   .32690E-03       -.15   .012     20.00
     28     468      .1       .0    -6  -.96525E-05   .32694E-03       -.15   .012     20.00
     29     469      .2       .0    -6  -.96540E-05   .32699E-03       -.15   .012     20.00
     30     470      .2       .0    -6  -.96558E-05   .32705E-03       -.15   .012     20.00
     31     471      .2       .0    -6  -.96581E-05   .32713E-03       -.15   .012     20.00
     32     472      .3       .0    -6  -.96612E-05   .32723E-03       -.15   .012     20.00
     33     473      .3       .0    -6  -.96645E-05   .32734E-03       -.15   .012     20.00
     34     474      .3       .0    -6  -.96684E-05   .32747E-03       -.15   .012     20.00
     35     475      .4       .0    -6  -.96725E-05   .32762E-03       -.15   .012     20.00
     36     476      .4       .0    -6  -.96767E-05   .32776E-03       -.15   .012     20.00
     37     477      .4       .0    -6  -.96810E-05   .32791E-03       -.15   .012     20.00
     38     478      .4       .0    -6  -.96853E-05   .32805E-03       -.15   .012     20.00
     39     479      .5       .0    -6  -.96890E-05   .32817E-03       -.15   .012     20.00
     40     480      .5       .0    -6  -.96922E-05   .32828E-03       -.15   .012     20.00
     41     481      .5       .0    -6  -.96946E-05   .32837E-03       -.15   .012     20.00
     42     482      .6       .0    -6  -.96964E-05   .32843E-03       -.15   .012     20.00
     43     483      .6       .0    -6  -.96977E-05   .32847E-03       -.15   .012     20.00
     44     484      .6       .0    -6  -.48491E-05   .32848E-03       -.15   .012     20.00


  Time:            23.0000

      i       n       x        z    Code       Q            v             h        th       Temp   Conc(1-NS)
 Qc(1-NS)
                    [L]      [L]            [V/T]         [L/T]          [L]      [-]       [C]     [M/L3]
 [VM/T.L3]

      1       1      .0      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      2       2      .0      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      3       3      .1      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      4       4      .1      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
      5       5      .1      1.0    -4   .00000E+00   .00000E+00       -.46   .141     20.00
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     6      6       .1      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
     7      7       .2      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
     8      8       .2      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
     9      9       .2      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    10     10       .3      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    11     11       .3      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    12     12       .3      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    13     13       .4      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    14     14       .4      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    15     15       .4      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    16     16       .4      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    17     17       .5      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    18     18       .5      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    19     19       .5      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    20     20       .6      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    21     21       .6      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    22     22       .6      1.0   -4   .00000E+00    .00000E+00       -.46   .141      20.00
    23    463       .0       .0   -6  -.48287E-05    .32711E-03       -.15   .012      20.00
    24    464       .0       .0   -6  -.96570E-05    .32709E-03       -.15   .012      20.00
    25    465       .1       .0   -6  -.96571E-05    .32710E-03       -.15   .012      20.00
    26    466       .1       .0   -6  -.96576E-05    .32711E-03       -.15   .012      20.00
    27    467       .1       .0   -6  -.96584E-05    .32714E-03       -.15   .012      20.00
    28    468       .1       .0   -6  -.96596E-05    .32718E-03       -.15   .012      20.00
    29    469       .2       .0   -6  -.96610E-05    .32722E-03       -.15   .012      20.00
    30    470       .2       .0   -6  -.96626E-05    .32728E-03       -.15   .012      20.00
    31    471       .2       .0   -6  -.96647E-05    .32735E-03       -.15   .012      20.00
    32    472       .3       .0   -6  -.96673E-05    .32744E-03       -.15   .012      20.00
    33    473       .3       .0   -6  -.96701E-05    .32753E-03       -.15   .012      20.00
    34    474       .3       .0   -6  -.96731E-05    .32764E-03       -.15   .012      20.00
    35    475       .4       .0   -6  -.96764E-05    .32775E-03       -.15   .012      20.00
    36    476       .4       .0   -6  -.96796E-05    .32786E-03       -.15   .012      20.00
    37    477       .4       .0   -6  -.96830E-05    .32798E-03       -.15   .012      20.00
    38    478       .4       .0   -6  -.96864E-05    .32808E-03       -.15   .012      20.00
    39    479       .5       .0   -6  -.96893E-05    .32818E-03       -.15   .012      20.00
    40    480       .5       .0   -6  -.96919E-05    .32827E-03       -.15   .012      20.00
    41    481       .5       .0   -6  -.96938E-05    .32834E-03       -.15   .012      20.00
    42    482       .6       .0   -6  -.96953E-05    .32839E-03       -.15   .012      20.00
    43    483       .6       .0   -6  -.96964E-05    .32842E-03       -.15   .012      20.00
    44    484       .6       .0   -6  -.48483E-05    .32843E-03       -.15   .012      20.00


  Time:          23.5000

     i      n        x        z    Code        Q             v             h        th       Temp   Conc(1-NS)
 Qc(1-NS)
                    [L]      [L]             [V/T]         [L/T]          [L]      [-]       [C]     [M/L3]

 [VM/T.L3]

     1      1       .0      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
     2      2       .0      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
     3      3       .1      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
     4      4       .1      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
     5      5       .1      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
     6      6       .1      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
     7      7       .2      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
     8      8       .2      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
     9      9       .2      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    10     10       .3      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    11     11       .3      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    12     12       .3      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    13     13       .4      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    14     14       .4      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    15     15       .4      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    16     16       .4      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    17     17       .5      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    18     18       .5      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    19     19       .5      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    20     20       .6      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    21     21       .6      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    22     22       .6      1.0   -4   .00000E+00    .00000E+00       -.47   .141      20.00
    23    463       .0       .0   -6  -.48292E-05    .32714E-03       -.15   .012      20.00
    24    464       .0       .0   -6  -.96586E-05    .32715E-03       -.15   .012      20.00
    25    465       .1       .0   -6  -.96589E-05    .32716E-03       -.15   .012      20.00
    26    466       .1       .0   -6  -.96593E-05    .32717E-03       -.15   .012      20.00
    27    467       .1       .0   -6  -.96601E-05    .32720E-03       -.15   .012      20.00
    28    468       .1       .0   -6  -.96611E-05    .32723E-03       -.15   .012      20.00
    29    469       .2       .0   -6  -.96623E-05    .32727E-03       -.15   .012      20.00
    30    470       .2       .0   -6  -.96637E-05    .32732E-03       -.15   .012      20.00
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   31    471       .2       .0   -6  -.96655E-05    .32738E-03       -.15   .012     20.00
   32    472       .3       .0   -6  -.96678E-05    .32746E-03       -.15   .012     20.00
   33    473       .3       .0   -6  -.96703E-05    .32754E-03       -.15   .012     20.00
   34    474       .3       .0   -6  -.96730E-05    .32763E-03       -.15   .012     20.00
   35    475       .4       .0   -6  -.96760E-05    .32773E-03       -.15   .012     20.00
   36    476       .4       .0   -6  -.96788E-05    .32784E-03       -.15   .012     20.00
   37    477       .4       .0   -6  -.96819E-05    .32794E-03       -.15   .012     20.00
   38    478       .4       .0   -6  -.96849E-05    .32803E-03       -.15   .012     20.00
   39    479       .5       .0   -6  -.96875E-05    .32812E-03       -.15   .012     20.00
   40    480       .5       .0   -6  -.96898E-05    .32820E-03       -.15   .012     20.00
   41    481       .5       .0   -6  -.96915E-05    .32826E-03       -.15   .012     20.00
   42    482       .6       .0   -6  -.96928E-05    .32831E-03       -.15   .012     20.00
   43    483       .6       .0   -6  -.96937E-05    .32833E-03       -.15   .012     20.00
   44    484       .6       .0   -6  -.48470E-05    .32834E-03       -.15   .012     20.00


 Time:           24.0000

    i      n      x        z    Code       Q             v           h       th      Temp  Conc(1-NS)
Qc(1-NS)
                 [L]      [L]            [V/T]        [L/T]        [L]      [-]        [C]    [M/L3]
[VM/T.L3]

    1      1       .0      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
    2      2       .0      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
    3      3       .1      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
    4      4       .1      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
    5      5       .1      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
    6      6       .1      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
    7      7       .2      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
    8      8       .2      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
    9      9       .2      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   10     10       .3      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   11     11       .3      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   12     12       .3      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   13     13       .4      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   14     14       .4      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   15     15       .4      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   16     16       .4      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   17     17       .5      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   18     18       .5      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   19     19       .5      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   20     20       .6      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   21     21       .6      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   22     22       .6      1.0   -4   .00000E+00    .00000E+00       -.47   .141     20.00
   23    463       .0       .0   -6  -.48309E-05    .32725E-03       -.15   .012     20.00
   24    464       .0       .0   -6  -.96615E-05    .32724E-03       -.15   .012     20.00
   25    465       .1       .0   -6  -.96615E-05    .32724E-03       -.15   .012     20.00
   26    466       .1       .0   -6  -.96618E-05    .32726E-03       -.15   .012     20.00
   27    467       .1       .0   -6  -.96624E-05    .32728E-03       -.15   .012     20.00
   28    468       .1       .0   -6  -.96633E-05    .32730E-03       -.15   .012     20.00
   29    469       .2       .0   -6  -.96644E-05    .32734E-03       -.15   .012     20.00
   30    470       .2       .0   -6  -.96656E-05    .32739E-03       -.15   .012     20.00
   31    471       .2       .0   -6  -.96671E-05    .32744E-03       -.15   .012     20.00
   32    472       .3       .0   -6  -.96691E-05    .32750E-03       -.15   .012     20.00
   33    473       .3       .0   -6  -.96711E-05    .32757E-03       -.15   .012     20.00
   34    474       .3       .0   -6  -.96733E-05    .32764E-03       -.15   .012     20.00
   35    475       .4       .0   -6  -.96756E-05    .32772E-03       -.15   .012     20.00
   36    476       .4       .0   -6  -.96779E-05    .32780E-03       -.15   .012     20.00
   37    477       .4       .0   -6  -.96803E-05    .32788E-03       -.15   .012     20.00
   38    478       .4       .0   -6  -.96827E-05    .32796E-03       -.15   .012     20.00
   39    479       .5       .0   -6  -.96848E-05    .32803E-03       -.15   .012     20.00
   40    480       .5       .0   -6  -.96866E-05    .32809E-03       -.15   .012     20.00
   41    481       .5       .0   -6  -.96879E-05    .32814E-03       -.15   .012     20.00
   42    482       .6       .0   -6  -.96889E-05    .32818E-03       -.15   .012     20.00
   43    483       .6       .0   -6  -.96897E-05    .32820E-03       -.15   .012     20.00
   44    484       .6       .0   -6  -.48450E-05    .32821E-03       -.15   .012     20.00
```

Check.out

```
 Program HYDRUS2
 Date:  15. 3.    Time:  14:29:10
 Time dependent boundary conditions
 Vertical plane flow, V = L*L
 Units: L = m    , T = hours, M = mmol


 Max. number of iterations           1000
 Absolute water content tolerance [-]  .00100
 Absolute pressure head tolerance [L]  .01000



MatNum, Param. array:

   Mat      Qr     Qs        Alfa         n          Ks       l

    1      .045   .410    .850E+01    .195E+01    .300E+00   .500
    2      .000   .300    .150E+02    .500E+01    .800E+01   .500

      Table of Hydraulic Properties which are interpolated in simulation
      ==================================================================

  theta         h        log h        C            K        log K         S

   .4100    -.100E-05  -.6000E+01   .4491E-04   .3000E+00  -.5229E+00    1.0000
   .4100    -.120E-05  -.5919E+01   .5360E-04   .3000E+00  -.5229E+00    1.0000
   .4100    -.145E-05  -.5838E+01   .6396E-04   .3000E+00  -.5229E+00    1.0000
   .4100    -.175E-05  -.5758E+01   .7633E-04   .3000E+00  -.5229E+00    1.0000
   .4100    -.210E-05  -.5677E+01   .9109E-04   .3000E+00  -.5229E+00    1.0000
   .4100    -.254E-05  -.5596E+01   .1087E-03   .3000E+00  -.5229E+00    1.0000
   .4100    -.305E-05  -.5515E+01   .1297E-03   .3000E+00  -.5229E+00    1.0000
   .4100    -.368E-05  -.5434E+01   .1548E-03   .3000E+00  -.5229E+00    1.0000
   .4100    -.443E-05  -.5354E+01   .1847E-03   .3000E+00  -.5229E+00    1.0000
   .4100    -.534E-05  -.5273E+01   .2204E-03   .3000E+00  -.5229E+00    1.0000
   .4100    -.643E-05  -.5192E+01   .2631E-03   .2999E+00  -.5230E+00    1.0000
   .4100    -.774E-05  -.5111E+01   .3139E-03   .2999E+00  -.5230E+00    1.0000
   .4100    -.933E-05  -.5030E+01   .3746E-03   .2999E+00  -.5230E+00    1.0000
   .4100    -.112E-04  -.4949E+01   .4471E-03   .2999E+00  -.5230E+00    1.0000
   .4100    -.135E-04  -.4869E+01   .5335E-03   .2999E+00  -.5230E+00    1.0000
   .4100    -.163E-04  -.4788E+01   .6366E-03   .2999E+00  -.5231E+00    1.0000
   .4100    -.196E-04  -.4707E+01   .7597E-03   .2998E+00  -.5231E+00    1.0000
   .4100    -.236E-04  -.4626E+01   .9066E-03   .2998E+00  -.5231E+00    1.0000
   .4100    -.285E-04  -.4545E+01   .1082E-02   .2998E+00  -.5232E+00    1.0000
   .4100    -.343E-04  -.4465E+01   .1291E-02   .2997E+00  -.5233E+00    1.0000
   .4100    -.413E-04  -.4384E+01   .1541E-02   .2997E+00  -.5233E+00    1.0000
   .4100    -.498E-04  -.4303E+01   .1839E-02   .2996E+00  -.5234E+00    1.0000
   .4100    -.599E-04  -.4222E+01   .2194E-02   .2996E+00  -.5235E+00    1.0000
   .4100    -.722E-04  -.4141E+01   .2618E-02   .2995E+00  -.5237E+00    1.0000
   .4100    -.870E-04  -.4061E+01   .3125E-02   .2994E+00  -.5238E+00    1.0000
   .4100    -.105E-03  -.3980E+01   .3729E-02   .2992E+00  -.5240E+00    1.0000
   .4100    -.126E-03  -.3899E+01   .4450E-02   .2991E+00  -.5242E+00    1.0000
   .4100    -.152E-03  -.3818E+01   .5310E-02   .2989E+00  -.5244E+00    1.0000
   .4100    -.183E-03  -.3737E+01   .6337E-02   .2987E+00  -.5247E+00    1.0000
   .4100    -.221E-03  -.3657E+01   .7562E-02   .2985E+00  -.5251E+00    1.0000
   .4100    -.266E-03  -.3576E+01   .9024E-02   .2982E+00  -.5255E+00    1.0000
   .4100    -.320E-03  -.3495E+01   .1077E-01   .2978E+00  -.5261E+00    1.0000
   .4100    -.385E-03  -.3414E+01   .1285E-01   .2974E+00  -.5267E+00    1.0000
   .4100    -.464E-03  -.3333E+01   .1534E-01   .2969E+00  -.5274E+00    1.0000
   .4100    -.559E-03  -.3253E+01   .1830E-01   .2963E+00  -.5283E+00    1.0000
   .4100    -.673E-03  -.3172E+01   .2184E-01   .2956E+00  -.5293E+00    1.0000
   .4100    -.811E-03  -.3091E+01   .2606E-01   .2947E+00  -.5306E+00    1.0000
   .4100    -.977E-03  -.3010E+01   .3110E-01   .2937E+00  -.5321E+00    1.0000
   .4100    -.118E-02  -.2929E+01   .3711E-01   .2925E+00  -.5339E+00     .9999
   .4100    -.142E-02  -.2848E+01   .4428E-01   .2910E+00  -.5360E+00     .9999
   .4100    -.171E-02  -.2768E+01   .5284E-01   .2893E+00  -.5386E+00     .9999
   .4099    -.206E-02  -.2687E+01   .6304E-01   .2873E+00  -.5417E+00     .9998
   .4099    -.248E-02  -.2606E+01   .7521E-01   .2848E+00  -.5454E+00     .9997
   .4099    -.298E-02  -.2525E+01   .8972E-01   .2819E+00  -.5498E+00     .9996
   .4098    -.359E-02  -.2444E+01   .1070E+00   .2785E+00  -.5552E+00     .9995
   .4097    -.433E-02  -.2364E+01   .1276E+00   .2744E+00  -.5616E+00     .9992
   .4096    -.521E-02  -.2283E+01   .1521E+00   .2696E+00  -.5693E+00     .9989
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    .4094   -.628E-02  -.2202E+01   .1813E+00   .2639E+00  -.5785E+00     .9984
    .4092   -.756E-02  -.2121E+01   .2159E+00   .2572E+00  -.5898E+00     .9977
    .4088   -.911E-02  -.2040E+01   .2568E+00   .2493E+00  -.6033E+00     .9967
    .4083   -.110E-01  -.1960E+01   .3051E+00   .2400E+00  -.6198E+00     .9953
    .4075   -.132E-01  -.1879E+01   .3618E+00   .2292E+00  -.6398E+00     .9932
    .4065   -.159E-01  -.1798E+01   .4279E+00   .2166E+00  -.6642E+00     .9903
    .4049   -.192E-01  -.1717E+01   .5041E+00   .2023E+00  -.6941E+00     .9861
    .4028   -.231E-01  -.1636E+01   .5907E+00   .1859E+00  -.7306E+00     .9802
    .3998   -.278E-01  -.1556E+01   .6869E+00   .1677E+00  -.7755E+00     .9720
    .3956   -.335E-01  -.1475E+01   .7904E+00   .1476E+00  -.8308E+00     .9604
    .3898   -.404E-01  -.1394E+01   .8964E+00   .1263E+00  -.8987E+00     .9446
    .3819   -.486E-01  -.1313E+01   .9972E+00   .1042E+00  -.9822E+00     .9231
    .3716   -.586E-01  -.1232E+01   .1082E+01   .8237E-01  -.1084E+01     .8947
    .3582   -.705E-01  -.1152E+01   .1137E+01   .6193E-01  -.1208E+01     .8581
    .3417   -.850E-01  -.1071E+01   .1149E+01   .4399E-01  -.1357E+01     .8128
    .3220   -.102E+00  -.9899E+00   .1112E+01   .2937E-01  -.1532E+01     .7588
    .2995   -.123E+00  -.9091E+00   .1025E+01   .1839E-01  -.1735E+01     .6974
    .2752   -.148E+00  -.8283E+00   .9009E+00   .1081E-01  -.1966E+01     .6308
    .2501   -.179E+00  -.7475E+00   .7557E+00   .5995E-02  -.2222E+01     .5620
    .2253   -.215E+00  -.6667E+00   .6081E+00   .3159E-02  -.2500E+01     .4939
    .2016   -.260E+00  -.5859E+00   .4724E+00   .1595E-02  -.2797E+01     .4292
    .1798   -.313E+00  -.5051E+00   .3567E+00   .7782E-03  -.3109E+01     .3694
    .1602   -.376E+00  -.4242E+00   .2635E+00   .3699E-03  -.3432E+01     .3157
    .1429   -.453E+00  -.3434E+00   .1914E+00   .1724E-03  -.3764E+01     .2683
    .1279   -.546E+00  -.2626E+00   .1373E+00   .7915E-04  -.4102E+01     .2271
    .1150   -.658E+00  -.1818E+00   .9761E-01   .3597E-04  -.4444E+01     .1917
    .1039   -.792E+00  -.1010E+00   .6896E-01   .1623E-04  -.4790E+01     .1614
    .0945   -.955E+00  -.2020E-01   .4849E-01   .7279E-05  -.5138E+01     .1357
    .0866   -.115E+01   .6061E-01   .3399E-01   .3254E-05  -.5488E+01     .1140
    .0799   -.138E+01   .1414E+00   .2377E-01   .1450E-05  -.5839E+01     .0957
    .0743   -.167E+01   .2222E+00   .1660E-01   .6454E-06  -.6190E+01     .0803
    .0696   -.201E+01   .3030E+00   .1158E-01   .2868E-06  -.6542E+01     .0674
    .0656   -.242E+01   .3838E+00   .8069E-02   .1273E-06  -.6895E+01     .0565
    .0623   -.292E+01   .4646E+00   .5620E-02   .5650E-07  -.7248E+01     .0473
    .0595   -.351E+01   .5455E+00   .3914E-02   .2506E-07  -.7601E+01     .0397
    .0571   -.423E+01   .6263E+00   .2724E-02   .1111E-07  -.7954E+01     .0333
    .0552   -.509E+01   .7071E+00   .1896E-02   .4925E-08  -.8308E+01     .0279
    .0535   -.614E+01   .7879E+00   .1320E-02   .2183E-08  -.8661E+01     .0234
    .0521   -.739E+01   .8687E+00   .9182E-03   .9673E-09  -.9014E+01     .0196
    .0510   -.890E+01   .9495E+00   .6389E-03   .4286E-09  -.9368E+01     .0164
    .0500   -.107E+02   .1030E+01   .4445E-03   .1899E-09  -.9721E+01     .0137
    .0492   -.129E+02   .1111E+01   .3093E-03   .8416E-10  -.1007E+02     .0115
    .0485   -.156E+02   .1192E+01   .2152E-03   .3729E-10  -.1043E+02     .0097
    .0480   -.187E+02   .1273E+01   .1497E-03   .1652E-10  -.1078E+02     .0081
    .0475   -.226E+02   .1354E+01   .1041E-03   .7321E-11  -.1114E+02     .0068
    .0471   -.272E+02   .1434E+01   .7246E-04   .3244E-11  -.1149E+02     .0057
    .0467   -.327E+02   .1515E+01   .5041E-04   .1437E-11  -.1184E+02     .0048
    .0465   -.394E+02   .1596E+01   .3507E-04   .6367E-12  -.1220E+02     .0040
    .0462   -.475E+02   .1677E+01   .2440E-04   .2821E-12  -.1255E+02     .0033
    .0460   -.572E+02   .1758E+01   .1697E-04   .1250E-12  -.1290E+02     .0028
    .0459   -.689E+02   .1838E+01   .1181E-04   .5538E-13  -.1326E+02     .0023
    .0457   -.830E+02   .1919E+01   .8216E-05   .2454E-13  -.1361E+02     .0020
    .0456   -.100E+03   .2000E+01   .5716E-05   .1087E-13  -.1396E+02     .0016
end

    .3000   -.100E-05  -.6000E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.120E-05  -.5919E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.145E-05  -.5838E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.175E-05  -.5758E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.210E-05  -.5677E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.254E-05  -.5596E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.305E-05  -.5515E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.368E-05  -.5434E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.443E-05  -.5354E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.534E-05  -.5273E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.643E-05  -.5192E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.774E-05  -.5111E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.933E-05  -.5030E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.112E-04  -.4949E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.135E-04  -.4869E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.163E-04  -.4788E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.196E-04  -.4707E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.236E-04  -.4626E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.285E-04  -.4545E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.343E-04  -.4465E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.413E-04  -.4384E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.498E-04  -.4303E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
    .3000   -.599E-04  -.4222E+01   .0000E+00   .8000E+01   .9031E+00    1.0000
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```
    .3000  -.722E-04  -.4141E+01   .2477E-10   .8000E+01   .9031E+00     1.0000
    .3000  -.870E-04  -.4061E+01   .5215E-10   .8000E+01   .9031E+00     1.0000
    .3000  -.105E-03  -.3980E+01   .1098E-09   .8000E+01   .9031E+00     1.0000
    .3000  -.126E-03  -.3899E+01   .2310E-09   .8000E+01   .9031E+00     1.0000
    .3000  -.152E-03  -.3818E+01   .4863E-09   .8000E+01   .9031E+00     1.0000
    .3000  -.183E-03  -.3737E+01   .1024E-08   .8000E+01   .9031E+00     1.0000
    .3000  -.221E-03  -.3657E+01   .2155E-08   .8000E+01   .9031E+00     1.0000
    .3000  -.266E-03  -.3576E+01   .4535E-08   .8000E+01   .9031E+00     1.0000
    .3000  -.320E-03  -.3495E+01   .9546E-08   .8000E+01   .9031E+00     1.0000
    .3000  -.385E-03  -.3414E+01   .2009E-07   .8000E+01   .9031E+00     1.0000
    .3000  -.464E-03  -.3333E+01   .4230E-07   .8000E+01   .9031E+00     1.0000
    .3000  -.559E-03  -.3253E+01   .8903E-07   .8000E+01   .9031E+00     1.0000
    .3000  -.673E-03  -.3172E+01   .1874E-06   .8000E+01   .9031E+00     1.0000
    .3000  -.811E-03  -.3091E+01   .3945E-06   .8000E+01   .9031E+00     1.0000
    .3000  -.977E-03  -.3010E+01   .8303E-06   .8000E+01   .9031E+00     1.0000
    .3000  -.118E-02  -.2929E+01   .1748E-05   .8000E+01   .9031E+00     1.0000
    .3000  -.142E-02  -.2848E+01   .3679E-05   .8000E+01   .9031E+00     1.0000
    .3000  -.171E-02  -.2768E+01   .7743E-05   .8000E+01   .9031E+00     1.0000
    .3000  -.206E-02  -.2687E+01   .1630E-04   .8000E+01   .9031E+00     1.0000
    .3000  -.248E-02  -.2606E+01   .3431E-04   .8000E+01   .9031E+00     1.0000
    .3000  -.298E-02  -.2525E+01   .7221E-04   .8000E+01   .9031E+00     1.0000
    .3000  -.359E-02  -.2444E+01   .1520E-03   .8000E+01   .9031E+00     1.0000
    .3000  -.433E-02  -.2364E+01   .3200E-03   .8000E+01   .9031E+00     1.0000
    .3000  -.521E-02  -.2283E+01   .6735E-03   .7999E+01   .9031E+00     1.0000
    .3000  -.628E-02  -.2202E+01   .1418E-02   .7999E+01   .9030E+00     1.0000
    .3000  -.756E-02  -.2121E+01   .2984E-02   .7997E+01   .9029E+00     1.0000
    .3000  -.911E-02  -.2040E+01   .6280E-02   .7994E+01   .9028E+00     1.0000
    .3000  -.110E-01  -.1960E+01   .1322E-01   .7988E+01   .9024E+00      .9999
    .2999  -.132E-01  -.1879E+01   .2781E-01   .7974E+01   .9017E+00      .9998
    .2998  -.159E-01  -.1798E+01   .5849E-01   .7946E+01   .9001E+00      .9994
    .2995  -.192E-01  -.1717E+01   .1229E+00   .7885E+01   .8968E+00      .9984
    .2988  -.231E-01  -.1636E+01   .2572E+00   .7756E+01   .8897E+00      .9960
    .2970  -.278E-01  -.1556E+01   .5340E+00   .7489E+01   .8744E+00      .9900
    .2925  -.335E-01  -.1475E+01   .1086E+01   .6946E+01   .8417E+00      .9750
    .2818  -.404E-01  -.1394E+01   .2102E+01   .5919E+01   .7722E+00      .9393
    .2582  -.486E-01  -.1313E+01   .3634E+01   .4246E+01   .6280E+00      .8606
    .2142  -.586E-01  -.1232E+01   .5027E+01   .2232E+01   .3487E+00      .7141
    .1526  -.705E-01  -.1152E+01   .4936E+01   .7475E+00  -.1264E+00      .5088
    .0923  -.850E-01  -.1071E+01   .3349E+01   .1567E+00  -.8049E+00      .3076
    .0494  -.102E+00  -.9899E+00   .1728E+01   .2338E-01  -.1631E+01      .1647
    .0247  -.123E+00  -.9091E+00   .7672E+00   .2898E-02  -.2538E+01      .0825
    .0120  -.148E+00  -.8283E+00   .3178E+00   .3298E-03  -.3482E+01      .0400
    .0058  -.179E+00  -.7475E+00   .1278E+00   .3623E-04  -.4441E+01      .0192
    .0027  -.215E+00  -.6667E+00   .5081E-01   .3922E-05  -.5407E+01      .0091
    .0013  -.260E+00  -.5859E+00   .2010E-01   .4221E-06  -.6375E+01      .0044
    .0006  -.313E+00  -.5051E+00   .7938E-02   .4533E-07  -.7344E+01      .0021
    .0003  -.376E+00  -.4242E+00   .3133E-02   .4863E-08  -.8313E+01      .0010
    .0001  -.453E+00  -.3434E+00   .1236E-02   .5216E-09  -.9283E+01      .0005
    .0001  -.546E+00  -.2626E+00   .4874E-03   .5593E-10  -.1025E+02      .0002
    .0000  -.658E+00  -.1818E+00   .1923E-03   .5998E-11  -.1122E+02      .0001
    .0000  -.792E+00  -.1010E+00   .7583E-04   .6431E-12  -.1219E+02      .0001
    .0000  -.955E+00  -.2020E-01   .2991E-04   .6896E-13  -.1316E+02      .0000
    .0000  -.115E+01   .6061E-01   .1180E-04   .7394E-14  -.1413E+02      .0000
    .0000  -.138E+01   .1414E+00   .4653E-05   .7929E-15  -.1510E+02      .0000
    .0000  -.167E+01   .2222E+00   .1835E-05   .8502E-16  -.1607E+02      .0000
    .0000  -.201E+01   .3030E+00   .7239E-06   .9116E-17  -.1704E+02      .0000
    .0000  -.242E+01   .3838E+00   .2855E-06   .9775E-18  -.1801E+02      .0000
    .0000  -.292E+01   .4646E+00   .1126E-06   .1048E-18  -.1898E+02      .0000
    .0000  -.351E+01   .5455E+00   .4442E-07   .1124E-19  -.1995E+02      .0000
    .0000  -.423E+01   .6263E+00   .1752E-07   .1205E-20  -.2092E+02      .0000
    .0000  -.509E+01   .7071E+00   .6910E-08   .1292E-21  -.2189E+02      .0000
    .0000  -.614E+01   .7879E+00   .2725E-08   .1386E-22  -.2286E+02      .0000
    .0000  -.739E+01   .8687E+00   .1075E-08   .1486E-23  -.2383E+02      .0000
    .0000  -.890E+01   .9495E+00   .4240E-09   .1593E-24  -.2480E+02      .0000
    .0000  -.107E+02   .1030E+01   .1672E-09   .1708E-25  -.2577E+02      .0000
    .0000  -.129E+02   .1111E+01   .6596E-10   .1832E-26  -.2674E+02      .0000
    .0000  -.156E+02   .1192E+01   .2601E-10   .1964E-27  -.2771E+02      .0000
    .0000  -.187E+02   .1273E+01   .1026E-10   .2106E-28  -.2868E+02      .0000
    .0000  -.226E+02   .1354E+01   .4047E-11   .2258E-29  -.2965E+02      .0000
    .0000  -.272E+02   .1434E+01   .1596E-11   .2423E-30  -.3062E+02      .0000
    .0000  -.327E+02   .1515E+01   .6296E-12   .2596E-31  -.3159E+02      .0000
    .0000  -.394E+02   .1596E+01   .2483E-12   .2772E-32  -.3256E+02      .0000
    .0000  -.475E+02   .1677E+01   .9794E-13   .2984E-33  -.3353E+02      .0000
    .0000  -.572E+02   .1758E+01   .3863E-13   .3092E-34  -.3451E+02      .0000
    .0000  -.689E+02   .1838E+01   .1524E-13   .3779E-35  -.3542E+02      .0000
    .0000  -.830E+02   .1919E+01   .6010E-14   .3664E-36  -.3644E+02      .0000
    .0000  -.100E+03   .2000E+01   .2370E-14   .1000E-36  -.3700E+02      .0000
End
```

Cum_Q.out

```
FileVersion=0003


 Program HYDRUS2
 Date:  15. 3.    Time:  14:29:10
 Time dependent boundary conditions
 Vertical plane flow, V = L*L
 Units: L = m    , T = hours, M = mmol

 All cumulative fluxes (CumQ) are positive out of the region (except infiltration)
       Time       CumQAP        CumQRP       CumQA        CumQR        CumQ3        CumQ1        CumQS        CumQ5
CumQ6        CumQ7        CumQ8        CumQ9     CRunOff      cEvapor      cInfiltr
        [T]         [V]           [V]         [V]          [V]          [V]          [V]          [V]          [V]
[V]          [V]          [V]          [V]         [V]          [V]         [V]

         .5000  -.23250E-01   .00000E+00  -.23250E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.26733E-23   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .23250E-01
        1.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.53466E-23   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        1.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.80198E-23   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        2.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.10693E-22   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        2.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.13366E-22   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        3.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.16040E-22   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        3.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.40907E-05   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        4.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.11275E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        4.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.22565E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        5.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.31839E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        5.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.40839E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        6.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.49785E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        6.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.58715E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        7.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.67597E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        7.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.76025E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        8.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.84400E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        8.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.92354E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        9.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.99583E-02   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
        9.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.10574E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       10.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.11132E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       10.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.11593E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       11.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.11985E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       11.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.12307E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       12.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.12581E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       12.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.12818E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       13.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.13026E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       13.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.13209E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       14.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.13369E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       14.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.13518E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       15.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.13657E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       15.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.13791E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       16.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.13921E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       16.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14037E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       17.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14153E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       17.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14265E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
       18.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14367E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
```

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      18.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14468E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      19.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14569E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      19.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14671E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      20.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14772E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      20.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14873E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      21.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.14975E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      21.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.15076E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      22.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.15178E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      22.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.15279E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      23.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.15381E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      23.5000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.15483E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
      24.0000  -.46500E-01   .00000E+00  -.46500E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00
.15584E-01   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .46500E-01
End
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h_Mean.out

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FileVersion=0003

       Time          hAtm       hRoot      hKode3      hKode1       hSeep      hKode5      hKode6      hKode7      hKode8      hKode9 ...
       [T]            [L]         [L]         [L]         [L]         [L]         [L]         [L]         [L]         [L]         [L]

         .5000        -.068        .000        .000        .000        .000        .000      -6.667        .000        .000        .000
        1.0000        -.063        .000        .000        .000        .000        .000      -6.667        .000        .000        .000
        1.5000        -.200        .000        .000        .000        .000        .000      -6.667        .000        .000        .000
        2.0000        -.240        .000        .000        .000        .000        .000      -6.667        .000        .000        .000
        2.5000        -.265        .000        .000        .000        .000        .000      -6.667        .000        .000        .000
        3.0000        -.285        .000        .000        .000        .000        .000      -6.666        .000        .000        .000
        3.5000        -.300        .000        .000        .000        .000        .000       -.170        .000        .000        .000
        4.0000        -.314        .000        .000        .000        .000        .000       -.122        .000        .000        .000
        4.5000        -.327        .000        .000        .000        .000        .000       -.123        .000        .000        .000
        5.0000        -.337        .000        .000        .000        .000        .000       -.123        .000        .000        .000
        5.5000        -.346        .000        .000        .000        .000        .000       -.123        .000        .000        .000
        6.0000        -.354        .000        .000        .000        .000        .000       -.123        .000        .000        .000
        6.5000        -.362        .000        .000        .000        .000        .000       -.123        .000        .000        .000
        7.0000        -.369        .000        .000        .000        .000        .000       -.124        .000        .000        .000
        7.5000        -.375        .000        .000        .000        .000        .000       -.125        .000        .000        .000
        8.0000        -.381        .000        .000        .000        .000        .000       -.126        .000        .000        .000
        8.5000        -.387        .000        .000        .000        .000        .000       -.127        .000        .000        .000
        9.0000        -.392        .000        .000        .000        .000        .000       -.129        .000        .000        .000
        9.5000        -.397        .000        .000        .000        .000        .000       -.133        .000        .000        .000
       10.0000        -.402        .000        .000        .000        .000        .000       -.135        .000        .000        .000
       10.5000        -.406        .000        .000        .000        .000        .000       -.138        .000        .000        .000
       11.0000        -.410        .000        .000        .000        .000        .000       -.140        .000        .000        .000
       11.5000        -.414        .000        .000        .000        .000        .000       -.142        .000        .000        .000
       12.0000        -.417        .000        .000        .000        .000        .000       -.144        .000        .000        .000
       12.5000        -.421        .000        .000        .000        .000        .000       -.145        .000        .000        .000
       13.0000        -.424        .000        .000        .000        .000        .000       -.145        .000        .000        .000
       13.5000        -.427        .000        .000        .000        .000        .000       -.146        .000        .000        .000
       14.0000        -.430        .000        .000        .000        .000        .000       -.147        .000        .000        .000
       14.5000        -.433        .000        .000        .000        .000        .000       -.147        .000        .000        .000
       15.0000        -.435        .000        .000        .000        .000        .000       -.147        .000        .000        .000
       15.5000        -.438        .000        .000        .000        .000        .000       -.148        .000        .000        .000
       16.0000        -.440        .000        .000        .000        .000        .000       -.148        .000        .000        .000
       16.5000        -.442        .000        .000        .000        .000        .000       -.148        .000        .000        .000
       17.0000        -.444        .000        .000        .000        .000        .000       -.148        .000        .000        .000
       17.5000        -.446        .000        .000        .000        .000        .000       -.148        .000        .000        .000
       18.0000        -.448        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       18.5000        -.450        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       19.0000        -.452        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       19.5000        -.454        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       20.0000        -.456        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       20.5000        -.457        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       21.0000        -.459        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       21.5000        -.460        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       22.0000        -.462        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       22.5000        -.463        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       23.0000        -.464        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       23.5000        -.466        .000        .000        .000        .000        .000       -.149        .000        .000        .000
       24.0000        -.467        .000        .000        .000        .000        .000       -.149        .000        .000        .000
end
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Run_Inf.out

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   TLevel      Time           dt       Iter    ItCum

     70   .50000000E+00   .152817E-01    4     1264
     96   .10000000E+01   .250603E-01    4     1366
    111   .15000000E+01   .426850E-01    5     1425
    123   .20000000E+01   .413152E-01    5     1486
    135   .25000000E+01   .413152E-01    6     1546
    147   .30000000E+01   .413152E-01    5     1604
    159   .35000000E+01   .413152E-01    4     1659
    180   .40000000E+01   .322289E-01    2     2791
    207   .45000000E+01   .134132E-01    2     7898
    222   .50000000E+01   .354709E-01    2     9949
    231   .55000000E+01   .274349E-01    2    11010
    238   .60000000E+01   .169049E+00    2    11024
    241   .65000000E+01   .166667E+00    2    11030
    243   .70000000E+01   .250000E+00    2    11034
    244   .75000000E+01   .500000E+00    4    11038
    251   .80000000E+01   .946297E-01    2    13069
    254   .85000000E+01   .166667E+00    2    13075
    256   .90000000E+01   .250000E+00    6    13084
    260   .95000000E+01   .111111E+00    2    14100
    264   .10000000E+02   .133334E+00    2    14108
    269   .10500000E+02   .190476E+00    3    15126
    276   .11000000E+02   .946295E-01    2    16147
    282   .11500000E+02   .740739E-01    2    17164
    285   .12000000E+02   .187500E+00    2    17170
    290   .12500000E+02   .190476E+00    3    18194
    297   .13000000E+02   .946295E-01    2    19214
    300   .13500000E+02   .166667E+00    3    19221
    305   .14000000E+02   .190476E+00    3    20262
    312   .14500000E+02   .972219E-01    3    21286
    317   .15000000E+02   .118518E+00    2    22475
    323   .15500000E+02   .833333E-01    2    23490
    330   .16000000E+02   .829629E-01    3    24508
    336   .16500000E+02   .833336E-01    2    25522
    341   .17000000E+02   .625000E-01    2    26535
    345   .17500000E+02   .156250E+00    3    26544
    347   .18000000E+02   .333333E+00    2    26548
    349   .18500000E+02   .250000E+00    2    26552
    350   .19000000E+02   .500000E+00    2    26554
    351   .19500000E+02   .500000E+00    2    26556
    352   .20000000E+02   .500000E+00    2    26558
    353   .20500000E+02   .500000E+00    2    26560
    354   .21000000E+02   .500000E+00    2    26562
    355   .21500000E+02   .500000E+00    2    26564
    356   .22000000E+02   .500000E+00    2    26566
    357   .22500000E+02   .500000E+00    2    26568
    358   .23000000E+02   .500000E+00    2    26570
    359   .23500000E+02   .500000E+00    2    26572
    360   .24000000E+02   .500000E+00    2    26574
End
```

h_Mean.out

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FileVersion=0003


 Program HYDRUS2
 Date:  15. 3.    Time:  14:29:10
 Time dependent boundary conditions
 Vertical plane flow, V = L*L
 Units: L = m    , T = hours, M = mmol

 All fluxes (v) are positive out of the region (except infiltration)
       Time         rAtm         rRoot         vAtm         vRoot        vKode3       vKode1        vSeep        vDrain       vBottom       vKode7       vKode8
vKode9       RunOff       Evapor       Infiltr      SnowLayer
        [T]         [L/T]         [L/T]         [L/T]         [L/T]         [V/T]        [V/T]        [V/T]         [V/T]        [V/T]        [V/T]        [V/T]
[V/T]         [L/T]        [L/T]        [L/T]         [L]

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REFERENCES

REFERENCES

Al-Hamaiedeh, H.D. (2010). "The impact of greywater reuse in irrigation on public health and safety." *Electronic Journal of Geotechnical Engineering*, 15, 1131-1138.

Anderson, J. (1996). "Current water recycling initiatives in Australia: scenarios for the 21st century." *Water Science and Technology*, 33(10) 37-43.

Atlantis Corporation. (2014). "Homepage." <http://www.atlantiscorp.com.au/> (March 17, 2015).

Bethune, G., and Smajstrla, A. (2001). "An innovative tailwater recovery and seepage-water interception system." *Bridging the Gap*, May 2001 1-7.

California Stormwater Quality Association (CASQA). (2003). *California Stormwater Quality Association stormwater best management practice handbook: New development and redevelopment*. CASQA, Menlo Park.

Department of Transportation, Engineering Services. (1998). *Method of test of permeability of soils*. California Test 220, State of California – Business, Transportation, and Housing Agency, Sacramento.

Environmental Protection Agency (EPA). (2015). "WaterSense interactive water budget tool." Office of Wastewater Management. <http://www.epa.gov/watersense/water_budget/application.html> (March 17, 2015).

Long Beach Water Department. (2015). "Water bill estimator." <www.lbwater.org/lbwd-water-bill-estimator> (March 17, 2015).

Los Angeles County Department of Public Works (LACDPW). (2002). *Development planning for storm water management: A manual for the standard urban storm water mitigation plan (SUSMP)*. Los Angeles County.

Los Angeles County Department of Public Works (LACDPW). (2009). *Stormwater best management practice design and maintenance manual for publicly maintained storm drain systems*. Los Angeles County.

Metropolitan Water District of Southern California. (2013). “Southern California World Water Forum.” <http://www.mwdh2o.com/mwdh2o/pages/education/world_water_01.html> (November 11, 2014).

Rozos, E., Makropoulos, C., and Butler, D. (2010). “Design robustness of local water-recycling schemes.” *Journal of Water Resources Planning and Management*, 136(5), 531-538.

Riverside County Flood Control and Water Conservation District. (2011). *Design handbook for low impact development best management practices*. Riverside County.

Schwankl, L., Prichard, L., and Hanson, B. (2007). “Tailwater return systems”. *ANR Publication*, University of California Agriculture and Natural Resources Communication Services, 8225 1-10.

Sciortino, A. (2011). *An integrated water recycling, treatment and efficient landscaping design system for water conservation at the Gold Star Manor, Long Beach*. Long Beach.

Smajstrla, A.G., Boman, B.J., Clark, G.A., Haman, D.Z., Harrison, D.S., Izuno, F.T., Pitts, D.J., and Zazueta, F.S.. Original date (1991), reviewed (2002). “Efficiencies of Florida agricultural irrigation systems.” Agricultural and Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Todd, D., and Mays, L. (2005). *Groundwater Hydrology*, Third Edition. John Wiley & Sons. Hoboken, New Jersey.

Van Genuchten, M., Leij, F., and Yates, R. (1991). *The RETC Code for Quantifying the Hydraulic Functions of Unsaturated Soils*. US Salinity Laboratory. Riverside, California.