IDENTIFYING TOTAL PHOSPHORUS SPECTRAL SIGNAL IN A TROPICAL ESTUARY LAGOON USING AN HYPERSPECTRAL SENSOR AND ITS APPLICATON TO WATER QUALITY MODELING

by

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ABSTRACT

The San Jose Lagoon (SJL) is located in the northern coast of Puerto Rico and is classified as a eutrophic water body. Site access difficulties establish the need for other monitoring alternatives to measure nutrients contamination. The Hyperion is a hyperspectral remote sensing imaging sensor which could provide adequate spectral resolution to monitor TP in such water system. In February, May, and August, 2006 the Hyperion collected hyperspectral groups of data from the SJL. Water quality field sampling and manual radio spectrometer data was concurrently obtained. Spectral indices were obtained from single, combined, and log combined bands statistical correlations, which were used to identify total phosphorus concentrations. A reflectance determination coefficient of 0.49 was obtained from the 467 to 529 nanometers bands ratio values, from which a polynomial algorithm was derived and used to produce a total phosphorus distribution map. In 1995 the U.S. Army Corp of Engineers (USCOE) developed the CH3D-WES and CE-QUAL-ICM hydrodynamic model for the SJL. The USCOE's model was updated with 2006 climate data. The water quality values obtained from the USCOE model compare well with the results obtained from our research. Color water quality maps were produced by the model and images with total phosphorus distribution, which provides the possible variability in its concentrations at different time periods. While it is recognized that TP has no unique reflectance spectral signal (which can be confused with reflectance from other water constituents) this study demonstrates the application of total phosphorus possible spectral indexes to monitor its content in eutrophic tropical lagoons though a hyperspectral sensor. Its use in water quality model

validation provides an additional tool to identify point and non-point source pollutants which otherwise might not be detected using traditional procedures. Nonetheless, the use of the Hyperion sensor for small water systems may need to be further evaluated due its less spatial resolution which causes additional errors in the retrieved spectral data. The algorithm produced by this research may be used to improve the calibration procedure of water quality models for the detection of TP in tropical lakes and lagoons after validation with corresponding field data.

RESUMEN

La Laguna San José (LSJ) está situada en la costa norte de Puerto Rico y está clasificada como un sistema eutroficado por su excesivo contenido de nutrientes. Debido a problemas de acceso se necesitan otras alternativas de monitoreo para adecuadamente medir la contaminación por nutrientes y su alcance. El Hyperion es un sensor hiperespectral con la resolución espectral necesaria que pudiese ser utilizado para monitorear la contaminación de nutrientes en este cuerpo de agua. Durante los meses de febrero, mayo y agosto del 2006 el Hyperion recogió datos espectrales de la Laguna San José. Concurrentemente, se recogieron muestras de agua y datos espectrales con el uso de un espectroradiómetro manual. Se produjo indicadores espectrales por las correlaciones estadísticas de las bandas espectrales sencillas, combinadas y el logaritmo de las combinadas, usadas para determinar la concentración de fósforo total como un indicador de contaminación por nutrientes. Se estimó un coeficiente de correlación de 0.49 obtenido por la combinación de las reflectancia correspondientes a las bandas con largos de onda de 467 y 529 nanómetros. Con esta correlación se derivó un algoritmo polínomial usado para la producción de una imagen hiperespectral con la posible distribución del fósforo total en el cuerpo de agua. En el 1995 el Cuerpo de Ingenieros de los Estados Unidos (CDI) desarrolló el modelo hidrodinámico de calidad de agua CH3-WES y CE-QUAL-ICM para la LSJ. El modelo del CDI fue actualizado con datos climátológicos del 2006 y sus resultados verificados con las imágenes del Hyperion luego de aplicado el algoritmo. Los valores de calidad de aguas producidos por el modelo del CDI comparan bien con los resultados obtenidos en nuestra investigación. Se produjeron mapas de calidad de agua coloreados para ambos el modelo y las imágenes, confirmando

la posible variabilidad por períodos de tiempo de las concentraciones del contaminante. Aunque se reconoce que aún no existe una señal espectral única para el fósforo (la cual pudiese ser confundida con reflectancia originada por otros constituyentes acuáticos) este estudio demuestra la aplicabilidad de los posibles indicadores espectrales de fósforo total obtenido para monitorear su contenido en lagunas tropicales eutroficadas con un sensor hiperespectral. Su uso en la validación de modelos de calidad de agua provee una herramienta adicional para la identificación de fuentes de contaminación precisada y no-precisadas que no pudiesen ser detectadas con el uso de procedimientos tradicionales. Sin embargo, el uso del sensor Hyperion en cuerpos de agua menores debe ser evaluado en más detalle debido a su menor resolución espacial lo cual pudiese causar errores adicionales en los datos espectrales obtenidos. El algoritmo producido por este trabajo de investigación pudiese ser usado para mejorar los procedimientos de calibración de modelos de calidad de agua para la identificación de fósforo total en lagos y lagunas tropicales, luego de su validación con los datos de campo correspondientes.

This work is dedicated to my wife, Ivette, my daughters, Laura Victoria and Verónica, but most especially to my mother Victoria who passed away on December 31, 2008 for their love, continuous support and motivation during the entire project

May God bless them all.

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1. INTRODUCTION

Water quality in the San Juan Bay National Estuary (SJBNE) has been historically classified as poor by the different federal and local regulatory government agencies in Puerto Rico. While the conditions have improved after the removal of several point sources during the 1980s there still exist concerns on its overall continuous water quality improvement. In 1995 the United States Army Corp of Engineers (USCOE) (Bunch *et al*., 2000) developed a water quality model for the San José Lagoon with several control and management recommendations to enhance water quality which have not been totally implemented. Some of the major difficulties in the implementation of successful water quality management practices are related with the sites remote locations, inaccessibility of adequate sampling locations, time consuming tasks, and higher cost. All or a combination, of the above may cause the project to be unfeasible.

Eutrophic conditions in this water system are caused by excessive nutrients mainly produced by past continuous raw sewage discharges originated from pumping station units located within the lagoon's contiguous urbanized zones. Total phosphorus concentrations in the lagoon continue to exceed the water quality standard established by the Puerto Rico Environmental Quality Board (PREQB). Present monitoring practices are centered on *in situ* sampling and expensive laboratory tasks which at the end, the results obtained may not be representative of the conditions of the whole water system.

Remote sensing technology has been used since the 1980's for the monitoring of inland and coastal waters (Shafique *et al*, 2003). The techniques used vary from an empirical-based method for the development of water quality maps to semi-empirical and analytical methods for producing quantitative water quality maps (Dekker, 1997).

Chapter 2 includes a literature review of relevant past research. Details of the theoretical aspects of hyperspectral remote sensing, and water quality are discussed in Chapter 3. Chapter 4 details the theory and analyzes the CH3D-WES and CE-QUAL-ICM hydrodynamic and water quality models, respectively, including applicability, kinetics, and data obtained for model calibration. Chapter 5 narrates the procedures and methodology used during the research, and Chapter 6 presents the discussion of the research results. Chapter 7 details the conclusions, recommendations for further activities, and the limitations encountered.

1.1 Justification

The SJBNE is located on the north region of Puerto Rico (Figure 1-1) and it is recognized for being one of the most threatened water bodies in the Caribbean. Historically, the main environmental impacts accounted for in the estuary have been: sanitary point sources, and non-point sources (San Juan Bay Estuary Program, 2000). The most common deleterious effects in the estuary waters are eutrophication and fecal pollution due to excessive nutrients contents primarily caused by wastewater discharges (Webb and Gómez-Gómez, 1998a). Eutrophication is a process where water bodies, such as lakes, estuaries, or slow-moving streams receive excess nutrients that stimulate excessive plant growth (algae, periphyton attached algae, and nuisance plants weeds). This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen concentration in the water when dead plant material decomposes and can cause other organisms to die.

Nutrients can come from many sources, such as fertilizers applied to agricultural fields, golf courses, and suburban lawns; deposition of nitrogen from the atmosphere; erosion of soil containing nutrients; and sewage treatment plant discharges (United States Geological Survey, 1999).

FIGURE 1-1: SAN JUAN BAY ESTUARY (FROM: SAN JUAN BAY ESTUARY PROGRAM, 2000)

The San José Lagoon water system is close to the estuary center and is divided in two segments: the Los Corozos lagoon to the northwest, and the San José Lagoon to the southwest. Both lagoons occupy an area of 457 hectares. Neither lagoon discharges to the ocean, thus, are not seriously affected by ocean tides. Its prevailing vegetation is mostly mangroves, however, they are surrounded on its west and southwest boundaries by residential developments which have caused excessive sedimentation to accumulate in its bottoms. The Suarez channel, which connects the San José lagoon with the Torrecillas lagoon, is approximately 3.86 kilometers in length, was originally narrow and shallow, and provided limited flowing conditions between both lagoons. The channel was deepened and widened. A channel section was excavated for the construction of boat decks which extended to 9.14 meters in depth. As a result of such excavation, the SJL may have become impacted by stratification of salt and fresh water creating low dissolved oxygen or anaerobic conditions (Ellis, 1976). These anaerobic zones trap nutrients and also serve as nutrients source. The excessive nutrients contents create large algae populations which create oxygen during the day but consumes it during the night.

In 1995, and as part of the hydrodynamic water quality model development, the COE prepared a bathymetric map for the estuary whose purpose at the lagoon was to fill the depression at the Suárez Channel up to average historical depths. The Suárez channel and other depressions located inside the lagoon are major sources of total phosphorus pollution within this water system. The filling purpose was directed at increasing the flow and time reduction water replenishment at the lagoon and channel. Ocean tides influence would also be increased and stratification would be reduced at the water column. As a result dissolved oxygen levels would augment and benthic population would be restored. A joint effort between the Puerto Rico Department of Natural and Environmental Resources (PRDNER), the USCOE, the United States Environmental Protection Agency (USEPA) and the PREQB was concerted to identify appropriate filling material sources. However, such tasks have not still been initiated.

The SJL is classified by the PREQB as Class SC waters (PREQB, 2003), coastal waters intended for uses where the human body may come into indirect contact with the water and for use and propagation of desirable species. The United States Geological Survey (USGS) conducted a sampling survey to the SJBE from December 1994 to July 1995 (Webb and Gómez-Gómez, 1998b). Several water quality parameters were tested during dry and wet periods: temperature, specific conductance, pH, dissolved oxygen, secchi depth, color, turbidity, total suspended solids, nutrients, chlorophyll-a and chlorophyll-b, and fecal coliforms. The most significant contributors of nutrients pollution at the SJL are the domestic discharges from houses surrounding Los Corozos lagoon and the discharge from raw sewage to the storm water drainage system controlled by the Baldorioty de Castro storm-water pumping station which discharged almost without interruption polluted waters to the SJL even during dry periods (Webb and Gómez-Gómez, 1998b). These pollutants discharges presently continue to both Los Corozos and San José lagoons.

Over the past 50 years remote sensing technology has been used throughout the world to obtain Earth related information with the use of satellite sensors. This technique has been used for numerous global monitoring and scientific research purposes including: agriculture, geology, urban planning, natural resource management, and others. Research results have been used to analyze global properties such as: environmental, climatic, hydrological, geological, geographic, oceanographic, and atmospheric. Its applicability in estuarine and coastal water quality has been concentrated in evaluating ocean color, such as chlorophyll-a and b, turbidity, sea surface temperature, suspended sediments, and others.

Hyperspectral remote sensing is a relatively new technology that is currently being investigated by researchers and scientists with regard to the detection and identification of minerals, terrestrial vegetation, and man-made materials. It combines imaging and spectroscopy in a single system which often includes large data sets and require new processing methods. Hyperspectral data sets are generally composed of about 100 to 200 spectral bands of relatively narrow bandwidths (5-10 nanometers), whereas, multispectral data sets are usually composed of about 5 to 10 bands of relatively large bandwidths (70-400 nanometers). The Hyperion is a space-borne hyperspectral sensor covering the 0.4 to 2.5 micrometers spectral range with 242 spectral bands at approximately 10 nanometers spectral resolution and 30 m spatial resolution from a 705 km orbit (Pearlman *et al.*., 2000). The system has two grating spectrometers; one visible/near infrared (VNIR) spectrometer (approximately 0.4 – 1.0 micrometers) and one short-wave infrared (SWIR) spectrometer (approximately 0.9 – 2.5 micrometers). Data are calibrated to radiance using both pre-mission and on-orbit measurements. The concept of hyperspectral remote sensing began in the mid-80's and to this point it has been used most widely by geologists for the mapping of minerals. Actual detection of materials is dependent on the spectral coverage, spectral resolution, and signal-to-noise of the spectrometer, the abundance of the material and the strength of absorption features for that material in the wavelength region measured.

1.2 Project Objectives

Several point and non-point sources pollution have been identified in the SJBNE and represent a potential threat to the site in maintaining its environmental balance and protection of the local surviving species. During 1994 and 1995, the United States Geological Survey (USGS) (Webb and Gómez-Gómez, 1998b), in cooperation with the USEPA and the PREQB, conducted water and sediments sampling survey on the SJBNE. While on certain section of the bay the conditions have improved, there are still degraded conditions at the Caño Martin Peña and San José Lagoon, the results of the survey reflected presence of toxic sediments deposited in the above surface water systems. Furthermore, anoxic and abiotic conditions persisted at both systems caused by stagnant water conditions with virtually no mixing during daily ocean tides events. The USGS conducted additional sampling at the lagoon from 2002 to 2005 for similar water quality parameters, including total phosphorus (USGS, 2005).

Monitoring of water pollution with satellite imaging will provide needed information related to the total phosphorus loadings to the lagoon. Remote sensing techniques are appropriate due to the complexity of the reserve's ecosystem particularly because of the larger mangrove population. This study will suggest the use of hyperspectral imaging as a total phosphorus pollution monitoring tool in tropical estuaries. The Hyperion hyperspectral sensor has the capability to define spectral profiles in the visible and near infrared bands where total phosphorus is suspected to reflect. Field reflectance validation will be required to correlate the satellite measurements with true phosphorus reflected water quality characteristics at the selected lagoon's sections, based on field sampling results. As the main objective of this research, an algorithm will then be developed to extract total phosphorus information from the satellite image based on reflectance characteristics. This data will be used to determine total phosphorus concentration in the lagoon waters. The results obtained from water quality model developed by the COE will be verified with the Hyperion sensor spectral results with predicted total phosphorus concentrations inside the San José Lagoon.

2. LITERATURE REVIEW

This section details a thorough literature review with cited references on related remote sensing and water quality research topics. Some are inherent and apparent optical properties, substrate in water spectra, spectral indices for chlorophyll-a turbidity, and phosphorus estimation, remote sensing applicability to water quality modeling, radiance spectra and remote sensing reflectance, light attenuation and suspended sediments in intraestuarine intercomparissons, use of LANDSAT imagery for nutrients and solids loading activities, and use of AVHRR in coastal sediment transport.

Imagery from satellite and aircraft remote sensing systems has been used in the assessment of water quality parameters such as temperature, chlorophyll-a, turbidity, and total suspended solids (TSS) for lakes and reservoirs (Lillesand *et al*., 1983; Lathrop and Lillesand, 1989), estuaries (Harding *et al.,* 1995), and tropical coastal areas (Ruiz-Azuara, 1995)**.**

Remote sensing has been used for water quality monitoring in surface water bodies around the world. Research studies (Shafique *et al*., 2003, Goodenough, 2001, Brezonik *et al*., 2005, Bagheri and Dios, 1998, Tilley and Baldwin, 2005, Yang *et al*., 2000) have been mostly centered on the modeling and development of concentration distribution maps for different water quality parameters based on its reflectance characteristics. Water quality is a large topic that can be divided into numerous categories with multiple data types being sensed (See Table 2-1).

TABLE 2-1: SUBCATEGORIES OF WATER QUALITY FOR REMOTE SENSING APPLICATIONS ("VISIBLE EARTH: WATER QUALITY, 2007")

Acid Deposition	Alkalinity	Benthic Index
Carbon Dioxide	Carcinogens	Chlorophyll
Conductivity	Contaminants	Dissolved Gases
Dissolved Solids	Hydrocarbons	Inorganic Matter
Light Transmission	Nitrogen Compounds	Nutrients
Organic Matter	Oxygen	pH
Phosphorus Compounds	Radioisotopes	Stable Isotopes
Suspended Solids	Toxic Chemicals	Trace Metals
Turbidity	Water Temperature	

A major disadvantage in measuring reflectance characteristics in surface waters is excessive solids contents, high turbidity, and algae population within the water column. Algae, in particular, is an important indicator of water quality; generally the lower the concentration the better the water. Algae blooms can lead to oxygen depletion and fish kills in lakes. Accumulation of algae at the surface prevents the growth of submerged aquatic plants (Newcomb, 2007). Different algae or chlorophyll concentrations change the spectral response.

Several satellite sensors have been developed, and are currently used to monitor global environmental conditions. Originally, multispectral scanners were used by the National Space Aeronautics and Space Administration (NASA) to monitor Earth's resources from space. Hyperspectral sensors represent state-of-the art technology with significantly higher spectral resolution (i.e. 224 bands), 30-meters in spatial resolution covering wavelengths from the 400 to 2500 nanometers (nm) in the visible and near infrared bands of the spectrum.

The Hyperion hyperspectral imaging sensor was tested for its capabilities over a range of water targets in Eastern Australia, including Moreton Bay in Southern Queensland (Brando and Dekker, 2003). Moreton Bay was the only Australian Earth Observing 1 (EO-1) Hyperion coastal site used for calibration/validation activities. A combination of turbid and humic river inputs, as well as the open ocean flushing, determines the water quality of the bay. The field campaigns were coincident with Hyperion overpasses, retrieval of inherent and apparent optical properties, substrate reflectance spectra, and water quality parameters. Environmental noise calculations demonstrate that Hyperion has sufficient sensitivity to detect optical water concentrations of colored dissolved organic matter, and suspended matter in the waters of Moreton Bay. A methodology was developed integrating atmospheric and hydro-optical radiative transfer models (MOD-TRAN-4, Hydrolight) to estimate the underwater light field. A matrix inversion method was applied to retrieve concentrations of chlorophyll-a, dissolved organic matter, and suspended matter, which were comparable to those estimated in the field on the days of the overpass.

Optical indicators of water quality have the potential of enhancing the abilities of resource managers to monitor water bodies in a timely and cost-effective manner (Shafique *et al*., 2003). In 1999, a Compact Airborne Spectrographic Imager (CASI) was flown over the relatively shallow Great Miami River (GMR), in Southwest Ohio, collecting hyperspectral bands of data. Concurrently, water quality samples and hand-held spectrometer data were collected directly from the river. Using correlations between the ground-truth data and combinations of spectral bands from the remotely sensed data, spectral indices where developed which could be used to estimate chlorophyll-a, turbidity, and phosphorus. In 2001, a similar study was conducted in which a CASI was flown over a portion of the Ohio River while ground-truth data were collected. These data were analyzed and tested against the spectral indices developed during the 1999 study. Spectral data and water quality parameters were correlated. The GMR's spectral indices for chlorophyll-a were applicable to the Ohio River data. However, slightly refined spectral indices for turbidity and phosphorus were required in the new environmental setting. The study demonstrated the application of the chlorophyll-a spectral index while revealing the limited reliability of the turbidity and phosphorus spectral indices.

Several studies have addressed the seasonal and spatial variability of surface Chromophoric Dissolved Organic Matter (CDOM) in the Mid-Atlantic (DeGranpre *et al*., 1996; Vodacek *et al*., 1997) and South Atlantic Bight (Nelson and Guarda, 1995). These studies have concluded that the major source for CDOM absorption is riverine runoff, resulting in a strong seasonal variability and a strong linear relationship between increasing salinity and decreasing CDOM for each season (though the relationship varied between seasons). CDOM is the optically measurable component of the dissolved organic matter in water. The CDOM is usually abundant in natural waters comprising a significant portion of the DOM (10-90%) (Thurman, 1985) and influences water leaving radiances (Carder, 1991), among other processes. CDOM is often present in concentrations sufficient to affect the color of lakes, estuaries, and near-shore coastal waters (Kirkpatrick *et al*., 2003). At higher concentrations, CDOM absorption extends to visible wavelengths and may inhibit primary production. The spectral absorption of

CDOM distribution and optical properties are influenced by physical, chemical and biological processes which contribute to its formation, transformation and degradation (Kowalczuk *et al*., 2003). Most of the CDOM in coastal environments has a terrestrial origin and is transported to the ocean through rivers. In inland waters, in situ production from phytoplankton decomposition and extraction from bottom sediments may be an important source of CDOM (e.g., Kowalczuk, 1999; Kahru and Mitchell, 2001; Twardowski and Donaghay, 2001; Boss *et al*., 2001). However, recent observations have shown that CDOM absorption does not correlate with chlorophyll-a (e.g., Nelson *et al*., 1998; Rochelle-Newall *et al*., 1999; Rochelle-Newall and Fisher, 2002).

Water quality models have been developed for more than half century. Recently, some more complicated models have been able of simulating water quality in a three dimensional variation. Even though water resources engineers have made a great progress in modeling program and structure, data input and output display remain to be improved for practical applications. Traditional water quality sampling can only provide point basis water quality condition as the initial data for water modeling. Remote sensing provides an efficient tool to acquire water quality data periodically for a large area. Also, Geographical Information Systems (GIS) provide a useful platform to present simulated results. In a recent work (Yang *et al*., 2000), remotely sensed data were adopted in a water quality model as initial data and provided a set of data for model calibration. Meanwhile, GIS was used to store water quality data and to present water quality variations. A link-with model, integrating a water quality model QUAL2E and an image processing and GIS package (ERDAS Imagine), was applied in a water quality monitoring system for a reservoir in Taiwan. The display of water quality simulation provides spatially-referenced information for decision-makers of eutrophication control.

The prediction of spectral water leaving radiance and remote sensing reflectance from a coupled physical/ecological/optical simulation is one of the goals of the ONR Hyperspectral Coastal Ocean Dynamics Experiment (HyCODE). This goal requires coupling a high resolution circulation model (ROMS) to provide realistic physical forcing to a dynamic ecological model that produces depth-dependent distributions of inherent optical properties (EcoSim), which are subsequently fed to a robust radiative transfer model (Ecolight) to generate the water leaving radiance and remote sensing reflectance at the sea surface. The 2001 HyCODE experiment (Bissett *et al*, 2001) off the coast of New Jersey provided a data that included measurements of local currents from towed ADCPs and CODAR, *in situ* inherent and apparent optical properties (IOPs and AOPs), sea surface remote sensing reflectance, pigment distributions, fluorescence, and ocean color remote sensing with which to validate a coupled numerical simulation.

The predictions over the New Jersey Bight have a 300 m resolution at the LEO-15 site, encompassing a total of 250,000 grid points. The ecological simulation is initialized from estimates of historical relationships between total phytoplankton, pigments, nutrients, CDOM, temperature and salinity. The mass constituents of the ecological model include specific IOP functions, which are used in numerically fast downwelling radiative transfer model to generate the time dependent spectral photon density for the calculation of primary production, light-dependent pigment adjustments and CDOM cycling. The resultant IOPs are then used once per simulated day to generate the Ecolight solution for spectral upwelling radiance and remote sensing reflectance. The ability to compare physical radiance measurements and remote sensing reflectance to simulated estimates provides an opportunity to validate numerical simulations via photon densities, rather than through derived products such as chlorophyll concentrations.

Bostater and Klemas (1988) described estuarine remote sensing instruments with respect to state-of-the-art capabilities. Remote sensing studies of estuaries can be considered as being of two different types: estuarine intercomparissons (between estuaries) and intraestuarine (within estuary assessments). Current research has allowed initial efforts of estuarine intercomparissons of light attenuations and suspended sediments. Remote sensing can provide inputs to mathematical models used for research and management of estuaries and near coastal waters. The *in situ* optical profiling approach is transferable to other estuarine studies.

A study was conducted in the coast of Sweden, and its main purpose was to obtain information of nutrient and solids loading situation along the Swedish coastline (Lindell *et al.*, 1985). Since the coastline is long it was convenient to use remote sensing techniques. The other purpose of the study was to serve as a basis for the application of laser bathymetry along the Swedish coastline. LANDSAT imagery was used for such study. Chromaticity technique was used instead of linear correlation with single LANDSAT bands. This technique eliminates disturbances affecting all bands in the same proportion. The image of chromaticity transformed values gave a measure of the turbidity in the area. Turbidity measurements were conducted with the use of Secchi disks. Each recorded sample in the water was compared with the statistics of the corresponding area in the chromatic image. An area of 25-50 pixels was chosen for statistics calculation. A calibration curve was then computed. The equation for the calibration curve was then used to calibrate the whole chromaticity image. Separate calibration curves were used for different scenes. One of the most important results obtained from this research relates to the fact that atmospheric corrections needs for LANDSAT images were significantly reduced for turbidity measurements, as long as ground truth data are obtained from the scene. The results also indicated the variation of solids loading to the Swedish coastline, as seen from the LANDSAT data of essentially the entire coastline, shows that the heaviest loading is found in the inner parts of the archipielagos and bays where paper industries dominate. In view of the above results, the aerial information from the satellite should considerably improve estimates of the total amount of suspended matter and biomass of Swedish waters. This research has helped determining the relative solids loading situation along the Swedish coastline, which was very important for the environmental planning and management of that coastal zone. Moreover, high turbidity was the limiting factor for the utility of laser bathymetry for coastal mapping.

As part of a comprehensive study of coastal Alabama and Mississippi, the U.S. Geological Survey (Stumpf, 1991) investigated the coastal sediment transport in Mobile Bay and the adjacent shelf. A satellite sensor from the National Oceanic and Atmospheric Administration (NOAA) called Advanced Very High Resolution Radiometer (AVHRR) was used to provide data on the variability of spatial pattern in the near-surface suspended sediment concentration. The image was processed using atmospheric corrections to remove haze and Rayleigh radiance in order to obtain water reflectance. Water samples were collected from Mobile Bay to determine temperature, salinity and suspended solids. The results of the study showed that the suspended solids load in Mobile Bay appeared to respond to high flows. The imagery could reveal spatial patterns in the Bay. During the high flow events most suspended sediment flowed straight through the Bay. In general, the results showed that the suspended sediment load in Mobile Bay appears to respond rapidly to changes in river discharge. In the studied events, the load peaked only for a few days.

Another interesting conclusion is that large plumes would appear only during high discharge while small plumes occurred under small flow conditions. Fischer (2002) used chlorophyll algorithms to describe coastal properties in the Monterey Bay through hyperspectral remote sensing. The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) was utilized to evaluate the dynamics of the marine environment. The images provided by the AVIRIS sensor were mosaicked, radiometrically and geometrically corrected. Chlorophyll information was derived from the composite AVIRIS image using the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) algorithm. The AVIRIS image was pre-processed and corrected for cross-track illumination effects. Atmospheric correction was completed using the FLAASH algorithm and mosaicked to form a composite image, and geometrically corrected for image distortions. The obtained results showed the effectiveness of the AVIRIS sensor over SeaWiFS in the representation of the coastal ocean in the Monterey Bay using the chlorophyll algorithm. The study demonstrated the utility of high spatial resolution in representing the coastal ocean in the Monterey Bay, and suggested additional research using higher hyperspectral resolution on the phytoplankton pigment spectral absorbance.

3. THEORETICAL BACKGROUND

3.1 Hyperspectral Remote Sensing Theory

Hyperspectral remote sensors measure the reflectance properties of constituents in the earth's surface. Hyperspectral data sets are generally composed of about 100 to 200 spectral bands of relatively narrow bandwidths (5-10 nanometers), whereas, multispectral data sets are usually composed of about 5 to 10 bands of relatively large bandwidths (70-400 nanometers).

Hyperspectral imagery has been used to detect and map a wide variety of materials having characteristic reflectance spectra. It has also been used by geologists for mineral mapping (Clark *et al*., 1992, 1995), and to detect soil properties including moisture, organic content, and salinity (Ben-Dor, 2002). Vegetation scientists have successfully used hyperspectral imagery to identify vegetation species (Clark *et al*., 1995), study plant canopy chemistry (Aber and Martin, 1995), and detect vegetation stress (Merton, 1999). Military personnel have used hyperspectral imagery to detect military vehicles under partial vegetation canopy, and many other military target detection objectives.

A hyperspectral image consists of about a hundred or more contiguous spectral bands, as shown in Figure 3-1. The characteristic spectrum of the target pixel is acquired in a hyperspectral image. The precise spectral information contained in a hyperspectral image enables better characterization and identification of targets.

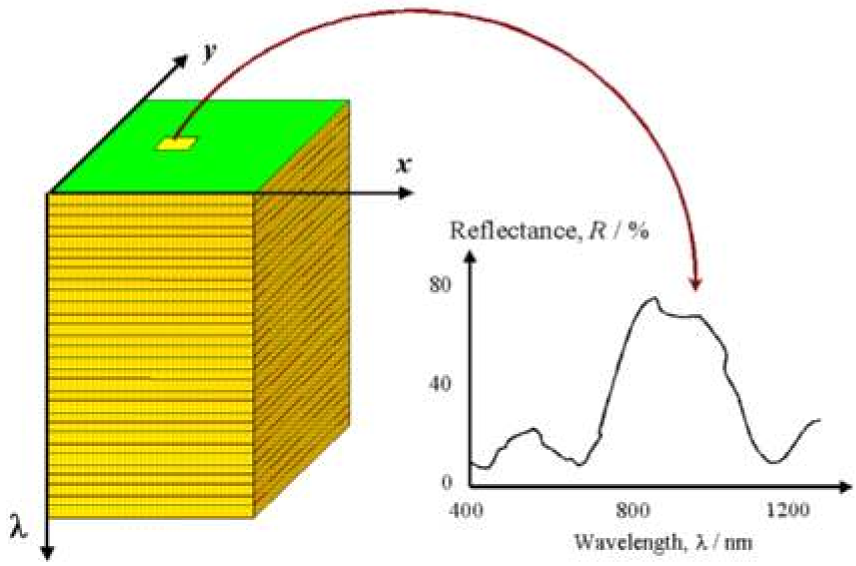

FIGURE 3-1: HYPERSPECTRAL IMAGE CUBE
(http://www.crisp.nus.edu.sg/~research/tutorial/image.htm)

The hyperspectral image data usually consists of over a hundred contiguous spectral bands, forming a three-dimensional (two spatial dimensions and one spectral dimension) image cube. Each pixel is associated with a complete spectrum of the imaged area. The high spectral resolution of hyperspectral images enables better identification of the land covers.

3.1.1 Radiometric Correction

Hyperspectral imaging sensors collect radiance data from either airborne or spaceborne platforms which must be converted to apparent surface reflectance before analysis techniques can take place. The radiance measured by any given system over a given object is influenced by such factors as changes in scene illumination, atmospheric conditions, viewing geometry, and instrument response characteristics. For generating mosaics of satellite images taken in visible and near infrared portion of the electromagnetic spectrum, it is usually necessary to apply a sun elevation correction and earth-sun-distance correction. The sun elevation correction accounts for the seasonal position of the sun relative to the earth. This is done by dividing each pixel value in a scene by the sine of the solar elevation angle for the particular time and location of the imaging. It normalizes the image data acquired under different solar illumination angles by calculating pixel brightness values assuming the sun was at the zenith on each date of sensing. The earth-sun distance correction is applied to normalize for the seasonal changes in the distance between the earth and the sun.

Empirical Line procedure is one of the approaches of radiometric correction (Roberts et *al.*, 1985) At least two spectrally uniform targets in the site of interest, one dark and one bright, are selected; their actual reflectances are then determined by field or laboratory measurements. The radiance spectra for each target are extracted from the image and then mapped to the actual reflectances using linear regression techniques. The gain and offset so-derived for each band are then applied to all pixels in the image to calculate their reflectances.

3.1.2 Atmospheric Correction

The atmosphere affects the brightness or radiance, recorded over any given point on the ground in two almost contradictory ways, when a sensor records reflected solar energy. First it attenuates (reduces) the energy illuminating a ground object (and being reflected from the object) at particular wavelengths, thus decreasing the radiance that can be measured. Second, the atmosphere acts as a reflector itself, adding a scattered, extraneous path radiance to the signal detected by the sensor which is unrelated to the properties of the surface. All atmospheric layers contain molecular gases, aerosol particles, and water vapor. Information about these constituents may be extracted from hyperspectral imagery by using specially designed algorithms. These algorithms are used to characterize the atmospheric characteristics in a reliable manner with a radiative transfer program (e.g. MODTRAN 4) to estimate the spectral ground reflectance to aid in ground-cover classification.

3.1.2.1 Radiative Transfer Code (MODTRAN4)

The Fast Line-of-sight Atmospheric Analysis of Spectral Hypercubes (FLAASH) module incorporates the MODTRAN4 which itself is a fully unclassified radiative transfer code and algorithm (Andersen *et al.*, 2000). It is a radiation transfer algorithm that is used to model the spectral absorption, transmission, emission and scattering characteristics of the atmosphere. The sensor reaching radiance algorithm (See section 3.2.2.2) is used by MODTRAN4 is defined based on the radiances produced by different energy paths originated from the solar irradiation entering the atmosphere (See Figure 3-2). The MODTRAN4 correlated-k algorithm, can efficiently and correctly (usually within 3-5%) calculate the scattering and absorption properties of realistic molecular, aerosol, and cloudy environments in the lower and middle atmosphere (Ratkowski *et al.*, 1998).

3.1.2.2 Sensor-Reaching Radiance Equation

The solar radiation is absorbed or scattered by the atmosphere during transmission to the ground surface, while the reflected or emitted radiation from the target is also absorbed or scattered by the atmosphere before it reaches the sensor, as shown by Figure 3-2. The ground surface receives not only the direct solar radiation but also sky light, or scattered radiation from the atmosphere. The nature of spaceborne remote sensing requires that solar radiation pass through the atmosphere before it is collected by the instrument. Because of this, remotely sensed images include information about the atmosphere as well as information about the surface.

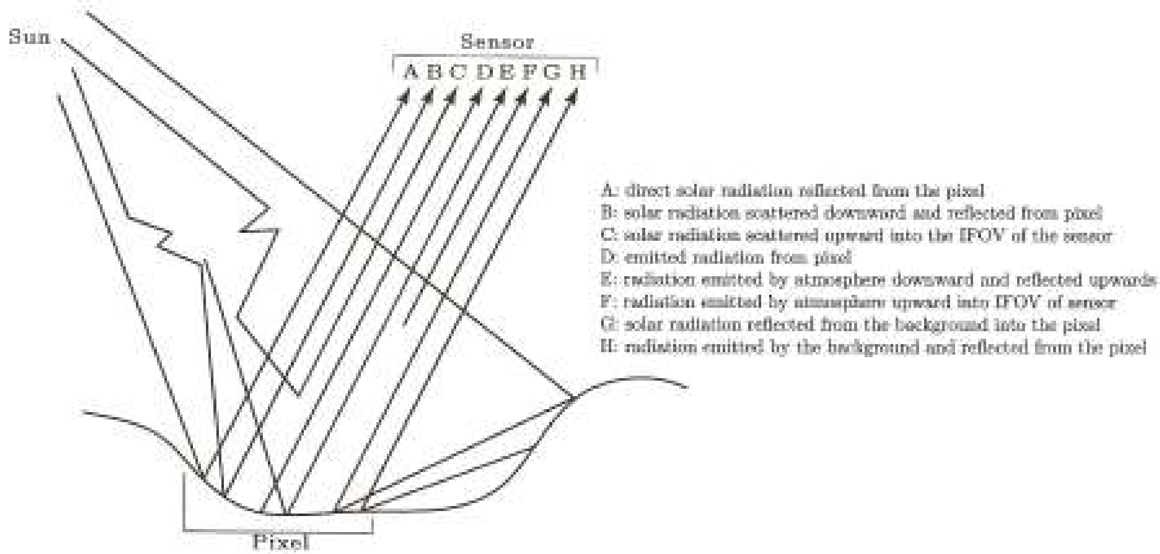

FIGURE 3-2: SENSOR RADIANCE PATHS (COLLINS, 1999)

Removing the influence of the atmosphere is a critical pre-processing step. To compensate for atmospheric effects, properties such as the amount of water vapor, distribution of aerosols, and scene visibility must be known. Because direct measurements of these atmospheric properties are rarely available, there are techniques that infer them from their imprint on hyperspectral radiance data. These properties are then used to constrain highly accurate models of atmospheric radiation transfer to produce an estimate of the true surface reflectance. Moreover, atmospheric corrections of this type can be applied on a pixel-by-pixel basis because each pixel in a hyperspectral image contains independent measurements of atmospheric water vapor absorption bands. FLAASH requires the presence of some supporting files in specific formats. If wavelength and full width half maximum values are not included in the ENVI header for the image being corrected, then FLAASH requires that these values be supplied in an ASCII column file. FLAASH also requires either a single scale factor (gain) to scale the input radiance data (DN values) in every band to units of microwatts/cm^2/nm/steradian, or an ASCII file containing separate values for each band. These files were prepared in advance of the FLAASH run (See Section 5.4).

The sensor-reaching radiance equation is divided in 3 distinct parts. That is, the direct term, the downwelled (diffuse) term, and the upwelled (path scatter or skylight) term (Ientilucci, 2007):

$$L = (\textit{Direct Reflected Radiance}) + (\textit{Diffuse Reflected Radiance}) + (\textit{Path Radiance}) \qquad (3\text{-}1)$$

Using the empirical line method, the equation expressed in radiometric terms is:

$$L_{sensor} = \left(\frac{E_s^{'} \cos\theta\tau_1}{\pi} + F * L_d \right) \tau_2 r + L_u \qquad (3\text{-}2)$$

where E'_s is the direct exo-atmospheric solar irradiance, θ is the angle at which direct solar irradiance is incident upon the target, τ_2 is the target sensor path transmission, r is the downwelling irradiance, F is a shape factor between 0 and 1 used to scale L_d, and L_u is the upwelled radiance.

The sensor radiance reaching equation is developed starting from the solar radiation energy entering the atmosphere up to the direct, diffuse, and path radiances received back by the satellite sensor. The equation assumes that all reflection is similar in all directions and in accordance with the bidirectional reflection distribution function (BDRF). The BRDF of a surface material is a function that describes the ratio of radiance, the amount of light reflected by the surface in every direction, measured in power per unit area per solid angle, to irradiance, the amount of light falling on the surface in every direction, (measured in power per unit area: Basri and Jacobs, 2003). BRDF is commonly specified in a local coordinate frame, in which the surface normal is fixed at the north pole. The BRDF of a Lambertian surface is constant, since such a surface reflects light equally in all direction, and it is equal to $1/\pi$ (Basri and Jacobs, 2003).

Considering that E_λ is the solar spectral radiance at the top of the atmosphere, with units in $W/m^2/\mu m$. E_λ is converted to $E_\lambda T_\lambda(\theta)$ after correction for scattering and absorption in the atmosphere, and $T_\lambda(\theta) = e^{-\tau\lambda sec\theta}$, where $\tau\lambda$ is the optical depth for a vertical path through the atmosphere, large optical depths mean larger extinctions due to absorption and scattering. The total optical depth may be written in terms of absorption, molecular, and aerosol scattering as:

$$\tau\lambda = \tau_a + \tau_R + \tau_M \tag{3-3}$$

The $sec\ \theta$ terms accounts for positive solar zenith angle θ. The irradiance is corrected accounting for the projection effect of the solar zenith angle (See Figure 3-3), then equation $E_\lambda = E_\lambda T_\lambda(\theta)$ is modified to:

$$E_\lambda = E_\lambda T_\lambda(\theta) \cos\ \theta \tag{3-4}$$

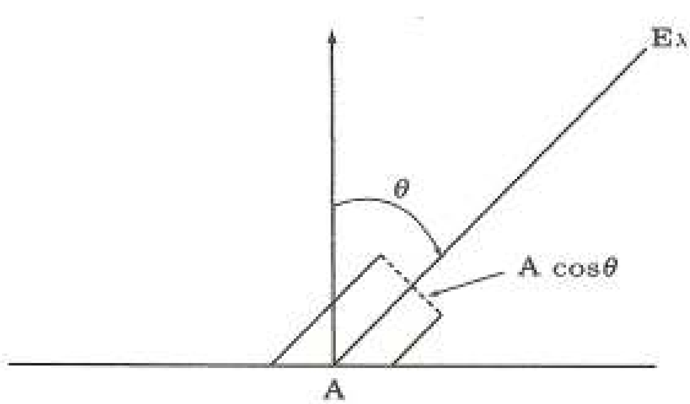

FIGURE 3-3: PROJECTION OF SOLAR ZENITH ANGLE

If the total downwelling scattered sky irradiance is $E_{d\lambda}$, then the portion falling on a pixel is $FE_{d\lambda}$, where F is the fraction of 2π steradians above the pixel. The scattering and absorption irradiance portion then includes the fractional downwelling sky irradiance:

$$E_\lambda T_\lambda(\theta) \cos\theta + FE_{d\lambda} \quad (3\text{-}5)$$

The atmosphere is at some finite temperature emitting radiation in all directions. The total irradiance emitted downwards by all parts of the atmosphere on the pixel is $E_{d\varepsilon\lambda}$. The portion falling on the pixel is $FE_{d\varepsilon\lambda}$, where F is the fraction of 2π steradians above the pixel. The term is further modified to consider the total downward irradiance:

$$E_\lambda T_\lambda(\theta) \cos\theta + F\,(E_{d\lambda} + E_{d\varepsilon\lambda}) \quad (3\text{-}6)$$

In most cases there will be background topography around the pixel reflecting solar irradiance and some of the reflected radiation will fall on the pixel. The total radiance reflected from the background is $L_{b\lambda}$. Assuming that the background is a Lambertian reflector, the radiance can then be converted to irradiance, and the background reflected irradiance reaching the pixel is $(1\text{-}F)\pi L_{b\lambda}$. Now inserting the background reflected irradiance we get the following equation:

$$E_\lambda T_\lambda(\theta) \cos\theta + F\,(E_{d\lambda} + E_{d\varepsilon\lambda}) + (1\text{-}F)\pi L_{b\lambda} \quad (3\text{-}7)$$

The surrounding terrain is at a finite temperature and emitting radiation, a portion of which will reach the pixel, $L_{b\varepsilon\lambda}$. After adding this term:

$$E_\lambda T_\lambda(\theta) \cos\theta + F\,(E_{d\lambda} + E_{d\varepsilon\lambda}) + (1\text{-}F)(\pi L_{b\lambda} + \pi L_{b\varepsilon\lambda}) \quad (3\text{-}8)$$

The terrain within the pixel will reflect a fraction of this radiation, called the reflectance, r. The reflected exitance is:

$$(E_\lambda T_\lambda(\theta) \cos\theta + F\,(E_{d\lambda} + E_{d\varepsilon\lambda}) + (1\text{-}F)(\pi L_{b\lambda} + \pi L_{b\varepsilon\lambda}))r \quad (3\text{-}9)$$

Assuming a Lambertian terrain,

$$\left(E_{\lambda}T_{\lambda}(\theta)\cos\theta + F\left(E_{d\lambda} + E_{d\varepsilon\lambda}\right) + (1-F)\left(\pi L_{b\lambda} + \pi L_{b\varepsilon\lambda}\right)\right)\frac{r}{\pi} \tag{3-10}$$

The terrain within the pixel is at a finite temperature and will emit radiation:

$$\varepsilon_{\lambda} L_{bb}(T) \tag{3-11}$$

where $L_{bb}(T)$ is the equivalent blackbody radiation at the effective radiating temperature and ε_{λ} is the terrain emissivity. As this term is added,

$$(E_{\lambda}T_{\lambda}(\theta)\cos\theta + F(E_{d\lambda} + E_{d\varepsilon\lambda}) + (1\text{-}F)(\pi L_{b\lambda} + \pi L_{b\varepsilon\lambda}))\frac{r}{\pi} + \varepsilon_{\lambda}L_{bb}(T) \tag{3-12}$$

The radiation leaving the pixel will be attenuated by the atmosphere between the pixel and the sensor:

$$T_{\lambda}(\phi) = e^{-\tau\lambda \sec\theta} \tag{3-13}$$

where ϕ is the local incidence angle and $\tau\lambda$ is the optical depth. Inserting the atmosphere radiance attenuation,

$$[(E_{\lambda}T_{\lambda}(\theta)\cos\theta + F(E_{d\lambda} + E_{d\varepsilon\lambda}) + (1\text{-}F)(\pi L_{b\lambda} + \pi L_{b\varepsilon\lambda}))\frac{r}{\pi} + \varepsilon_{\lambda}L_{bb}(T)]\ T_{\lambda}(\phi) \tag{3-14}$$

Since a portion of the solar radiation falling on the atmosphere will be scattered into the IFOV (Immediate Field of View) of the sensor $L_{u\lambda}$. The IFOV is a measure of the spatial resolution of a remote sensing imaging system. It is the most common measure of spatial resolution and can be defined as that area on the ground that is viewed by the instrument from a given altitude at any given time. After adding this term,

$$[(E_{\lambda}T_{\lambda}(\theta)\cos\theta + F(E_{d\lambda} + E_{d\varepsilon\lambda}) + (1\text{-}F)(\pi L_{b\lambda} + \pi L_{b\varepsilon\lambda}))\frac{r}{\pi} + \varepsilon_{\lambda}L_{bb}(T)]\ T_{\lambda}(\phi) + L_{u\lambda} \tag{3-15}$$

The last term of this equation refers to the *path radiance* $L_{u\varepsilon\lambda}$, which is the atmosphere emitted radiation on the IFOV.

$$[(E_\lambda T_\lambda(\theta)\cos\theta + F\,(E_{d\lambda} + E_{d\varepsilon\lambda}) + (1\text{-}F)(\pi L_{b\lambda} + \pi L_{b\varepsilon\lambda}))\frac{r}{\pi} + \varepsilon_\lambda L_{bb}(T)]\ T_\lambda(\phi) + L_{u\lambda} + L_{u\varepsilon\lambda} \qquad (3\text{-}16)$$

3.1.2.3 Aerosol Estimation

Aerosols have an indirect radiative forcing through their modification of cloud properties. These effects can be monitored through their changes in size distribution in the vicinity of cloud fields. Aerosol retrieval amount is determined by FLAASH using reflectance obtained from the MODerate resolution Image Spectroradiometer (MODIS) measured in the visible and mid-infrared bands with uncertainties less than 2% (Guenther *et al*., 2002). These values are used in the development of the overland and over-ocean algorithms used by FLAASH to estimate aerosol retrieval. The reflectance along with the MODIS cloud mask product identified as MOD/MYD35 (Ackerman *et al*., 1998) and meteorological data from the National Center for Environmental Prediction (NCEP) provide the input for the algorithms. As in the land algorithm, after the water vapor, ozone, and carbon dioxide corrections are applied, the first step in the ocean algorithm is to organize the reflectance from the six wavelengths for aerosol retrievals used in the procedure ($\rho_{0.55}$, $\rho_{0.66.}$, $\rho_{0.86}$, $\rho_{1.24}$, $\rho_{1.6}$, and $\rho_{2.13}$) into nominal 10-km boxes of 20 X 20 pixels at 500-m resolution . This requires degrading the resolution of the 250 m channels ($\rho_{0.66}$ and $\rho_{0.86}$). The ocean algorithm requires all 400 pixels in the box to be identified as ocean pixels by the MOD/MYD35 mask. This helps to minimize problems introduced by shallow water near the coasts. If any land is encountered, the entire box is left for the land algorithm (Remer *et al*., 2004). The algorithm includes brighter surfaces, which expands the geographical extent of the land retrieval. Dark pixels are then selected based only on their reflectance at 2.13 μm. To be selected, a pixel must fall within the range of $0.01 \leq \rho_{2.13} \leq 0.25$.

3.1.3 Differences Between Multispectral and Hyperspectral Data

Multispectral airborne and satellite systems have been employed for gathering data in the fields of agriculture and food production, geology, oil and mineral exploration, geography and urban to non-urban localities (Landgrebe, 1999). The advantage of using satellite remote sensing systems was to provide both the synoptic view space provides and the economies of scale, since data over large areas could be gathered quickly and economically from such platforms (Landgrebe, 1999).

Most multispectral imagers (e.g., LANDSAT 7 + ETM, SPOT, AVHRR) measure radiation reflected from a surface at a few wide, separated wavelength bands. Most hyperspectral imagers (See Table 3-1) measure reflected radiation at a series of narrow and contiguous wavelength bands. A pixel in a hyperspectral image looks like a spectrum that would be measured by laboratory spectroscopy.

Multispectral remote sensing systems use parallel sensor arrays that detect radiation at a small number of broad wavelength bands. According to Smith (2001a), most multispectral satellite systems measure between three and six spectral bands within the visible to middle infrared region of the electromagnetic spectrum.

TABLE 3-1: CURRENT AND RECENT HYPERSPECTRAL SENSORS AND DATA PROVIDERS

Satellite Sensor	Airborne Sensor	Manufacturer	Number of Bands	Spectral Range
FTHSI on MightySat II		Air Force Research Lab	256	0.35 to 1.05 mm
Hyperion on EO-1		NASA Goddard Space Flight Center	220	0.4 to 2.5 mm
	AVIRIS (Airborne Visible Infrared Imaging Spectrometer)	AVIRIS (Airborne Visible Infrared Imaging Spectrometer)	224	0.4 to 2.5 mm
	HYDICE (Hyperspectral Digital Imagery Collection Experiment)	Naval Research Lab	210	0.4 to 2.5 mm
	PROBE-1	Earth Search Sciences Inc.	128	0.4 to 2.5 mm
	CASI (Compact Airborne Spectrographic Imager)	ITRES Research Limited	up to 228	0.4 to 1.0 mm
	HyMap	Integrated Spectronics	100 to 200	Visible to thermal infrared
	EPS-H (Environmental Protection System)	GER Corporation	VIS/NIR (76), SWIR1 (32), SWIR2 (32), TIR (12)	VIS/NIR (.43 to 1.05 mm), SWIR1 (1.5 to 1.8 mm), SWIR2 (2.0 to 2.5 mm), and TIR (8 to 12.5 mm)
	DAIS 7915 (Digital Airborne Imaging Spectrometer)	GER Corporation	VIS/NIR (32), SWIR1 (8), SWIR2 (32), MIR (1), TIR (6)	VIS/NIR (0.43 to 1.05 mm), SWIR1(1.5 to 1.8 mm), SWIR2 (2.0 to 2.5 mm), MIR (3.0 to 5.0 mm)
	DAIS 21115 (Digital Airborne Imaging Spectrometer)	GER Corporation	VIS/NIR (76), WIR1 (64), SWIR2 (64), MIR (1), TIR (6)	VIS/NIR (0.40 to 1.0 mm), SWIR1 (1.0 to 1.8 mm),
	AISA (Airborne Imaging Spectrometer)	Spectral Imaging	up to 288	0.43 to 1.0 mm

There are, however, some systems that use one or more thermal infrared bands. Multispectral remote sensing allows for the discrimination of different types of vegetation, rocks and soils, clear and turbid water, and selected man-made materials (Smith, 2001a). To obtain data of a higher spectral resolution compared to multispectral data, satellites or airborne hyperspectral sensors are used (Smith, 2001b). Hyperspectral data has large file sizes and covers a smaller target area, i.e. 10 miles by 10 miles, but they have higher spatial resolution with pixels of 17 to 20 meters with continuous spectrum. Multispectral data is taken in broader bands which do not provide some of the information necessary for the classification and separation of many plant and rock types.

Hyperspectral remote sensing imagers acquire many, very narrow, contiguous spectral bands throughout the visible, near-infrared, mid-infrared, and thermal infrared portions of the electromagnetic spectrum. Hyperspectral sensors typically collect 100 or more bands enabling the construction of an almost continuous reflectance spectrum for every pixel in the scene. Contiguous, narrow bandwidths characteristic of hyperspectral data allow for in-depth examination of earth surface features which would otherwise be undetected within the relatively coarse bandwidths acquired with multispectral scanners.

Over the past decade, extensive research and development has been carried out in the field of hyperspectral remote sensing. Now with commercial airborne hyperspectral imagers such as CASI and Hymap and the launch of satellite-based sensors such as Hyperion, hyperspectral imaging is fast moving into the mainstream of applied remote sensing research studies. Hyperspectral images have found many applications in water resource management, agriculture and environmental monitoring (Smith, 2001b). It is important to point out that there is not necessarily a difference in spatial resolution between hyperspectral and multispectral data but rather in their spectral resolutions.

3.1.4 Hyperion Hyperspectral Sensor

The Hyperion instrument provides a new class of Earth observation data for improved Earth surface characterization (http://eo1.usgs.gov/hyperion.php). Hyperion represents a science grade instrument with quality calibration based on heritage from the LEWIS Hyperspectral Imaging Instrument (HSI). Its capabilities provide resolution of surface properties into hundreds of spectral bands versus the ten multispectral bands flown on traditional Landsat imaging missions. Through these spectral bands, complex land eco-systems can be imaged and accurately classified. It covers the 0.4 to 2.5 micrometers spectral range with 242 spectral bands at approximately 10 nanometers spectral resolution and 30 m spatial resolution from a 705 km orbit (Pearlman *et al*., 1999). Such variety in spectral bands is necessary to identify different spectral signals, including vegetation species present inside a small area such as the SJBNES, particularly swamp lands (http://eo1.gsfc.nasa.gov/new/general/firsts/hyperion.html), distinguish between the bay's bottom bed and brushes, and identify planted areas. Other sensors, such as Thematic Mapper (installed in the Landsat satellites), have been considered. However, most of the available sensors have much lower spatial and spectral resolutions not useful for the SJBNES study due to the site's small area. Hyperion captures 256 spectra each from each band over a 7.5Km-wide swath perpendicular to the satellite motion along an up to 160 km path length. The system has two grating spectrometers (Kruse, 2003); one visible/near infrared (VNIR) spectrometer (approximately 0.4 – 1.0 micrometers) and one short-wave infrared (SWIR: approximately 0.9 – 2.5 micrometers). Figure 3-4 shows the

Hyperion sensor instrument installed at the National Aeronautics and Space Administration (NASA) Earth Observing-1 (EO-1) satellite. The data product distributed by the USGS EROS Data Center (EDC) consists of radiometrically corrected (Level 1R) data. There is no geometric correction or geo-reference provided.

In order to understand the precision and accuracy that can be achieved in the estimate of an environmental variable with Hyperion, it is necessary to estimate the overall sensitivity of the entire sensor–atmosphere–air–water interface system for detecting changes in radiance or reflectance. There are two modeling approaches to determine the relationship between the inherent and apparent optical properties of the water column and the water constituents: the analytical modeling and the radiative transfer modeling approach. (Brando and Dekker, 2003).

FIGURE 3-4: HYPERION HYPERSPECTRAL SENSOR AT EO-1

3.2 Water Quality Theory

3.2.1 Estuaries

Estuaries are defined as embayments where freshwater and seawater mix, and can be classified according to different criteria depending on one's interest like their geological history, morphology, hydro physical mixing pattern, climatic situation, biological activity, tidal response, and degree of pollution (http://www.icsu-scope.org/downloadpubs/scope35/chapter13.html.). In estuaries, fresh water is less dense than seawater and, therefore, freshwater flows above it. Salinity in estuaries depends on the tidal cycles originated from the oceans or seas. In order to survive under these conditions, vegetation and animals must be able to adapt fast to these changes in salinities.

Estuaries are often associated with high rates of biological productivity. They are among the most productive ecosystems in the world and are home to unique plant and animal communities (Weiss and Duffy, 2008). Many animal species rely on estuaries for food and as places to nest and breed. An estuary has very little wave action, so it provides a calm refuge from the open sea.

3.2.2 Total Phosphorus (TP) in Surface Water Systems

Phosphorus in freshwater and marine systems exists in either a particulate phase or a dissolved phase. Particulate matter includes living and dead plankton, precipitates of phosphorus, phosphorus adsorbed by particulates, and amorphous phosphorus. The dissolved phase includes inorganic phosphorus (generally in the soluble orthophosphate form), organic phosphorus excreted by organisms, and macromolecular colloidal phosphorus (Osmond *et al*, 1995)

The organic and inorganic particulate and soluble forms of phosphorus undergo continuous transformations. The dissolved phosphorus (usually as orthophosphate) is assimilated by phytoplankton and altered to organic phosphorus. Phytoplankton is then ingested by detritivores or zooplankton. Over half of the organic phosphorus taken up by zooplankton is excreted as inorganic phosphorus. Continuing the cycle, the inorganic phosphorus is rapidly assimilated by phytoplankton (Smith *a*, 1990; Holtan *et al*., 1988).

Lakes and reservoir sediments serve as phosphorus repositories. Phosphorus-containing particles settle to the substrate and are rapidly covered by sediment. Continuous accumulation of sediment will leave some phosphorus too deep within the substrate to be reintroduced to the water column. Thus, some phosphorus is removed permanently from biocirculation (Smith, 1990; Holtan *et al*., 1988).

3.2.3 Environmental Impacts due to High Total Phosphorus Levels

Soil, nutrients, and water combine to feed marsh grasses, sea grasses, and other types of vegetation. If an estuary has too many nutrients, excessive algae will grow, creating algae blooms. These algae blooms block sunlight and can suffocate fish and plant life by using up valuable oxygen from the water. Nutrients can enter estuaries from sewage treatment plants, septic systems, fertilizers used in farming and on lawns, and polluted air (http://www.epa.gov/owow/estuaries/kids/about/nutrients.htm). Nutrients such as nitrogen and phosphorus are necessary for growth of plants and animals, which coexist on land and aquatic environments (particularly in fresh and marine waters), and support a healthy aquatic ecosystem. In excess, however, nutrients can contribute to fish disease, red or brown tide, algae blooms, and low dissolved oxygen. Sources of nutrients include point and non-point sources such as sewage treatment plant discharges, stormwater runoff from lawns and agricultural lands, faulty or leaking septic systems, sediment in runoff, animal wastes, atmospheric deposition originating from power plants or vehicles, and groundwater discharges. When wastewater, sediments, sewage, or fertilizers are introduced into a waterway, the concentration of available nutrients in that system will increase, resulting in a condition known as eutrophication (Heip 1995, Lalli 1997, Paerl *et al*. 1998). See section 3.3.2.1 for eutrophication facts.

3.2.4 TP Water Quality Requirements

Water quality standards are the foundation of the water quality-based control program mandated by the Clean Water Act on 1972. Water Quality Standards define the goals for a waterbody by designating its uses, setting criteria to protect those uses, and establishing specific regulatory compliance requirements to protect water quality from pollutants (http://www.epa.gov/waterscience/standards/about/). A water quality standard consists of four basic elements:

- designated uses of the water body (e.g., recreation, water supply, aquatic life, agriculture),
- water quality criteria to protect designated uses (numeric pollutant concentrations and narrative requirements),
- an antidegradation policy to maintain and protect existing uses and high quality waters, and

- general policies addressing implementation issues (e.g., low flows, variances, mixing zones).

The EPA water quality criteria state that phosphates should not exceed 0.05 mg/l if streams discharge into lakes or reservoirs, 0.025 mg/l within a lake or reservoir, and 0.1 mg/l in streams or flowing waters not discharging into lakes or reservoirs to control algal growth (USEPA, 1986). Surface waters that are maintained at 0.01 to 0.03 mg/l of total phosphorus tend to remain uncontaminated by algal blooms.

3.2.5 Water Quality in the San José Lagoon

The San José Lagoon is designated as Class SC surface waters (PREQB, 2003). Class SC-designated use waters are coastal waters intended for uses where the human body may come in indirect contact with the water (such as fishing, boating, etc.) and for use in propagation and preservation of desirable species. The sanitary quality standard for Class SC-designated use surface waters, with the exception of primary use contact recreation, is based on the fecal coliform bacteria concentrations as follows: the geometric mean concentration of at least five samples obtained in sequential order should not exceed 2000 colonies per 100 mL for fecal coliform bacteria, and not more than 20 percent of the samples (one in a set of five) should exceed 4000 colonies per 100 mL of fecal coliform bacteria. The EQB water quality standards for Class SC waters also require the dissolved oxygen to be over 4.0 mg/l (Puerto Rico Environmental Quality Board, 2003). For Class SC surface waters used intensively for primary contact recreation, such as the Isla Verde public beach, the sanitary quality constraints are more stringent. Several conditions within the SJL have resulted in its overall water quality degradation and impairment.

3.2.5.1 Eutrophication

Water quality concerns in the lagoon include high concentrations of coliform bacteria, low dissolved oxygen concentrations, eutrophication, and the presence of toxic substances (Kennedy *et al*., 1996). Eutrophication is an increase in chemical nutrients, typically compounds containing nitrogen or phosphorus in an ecosystem, and may occur on land or in water. It is a common water quality problem in developing as well as in developed countries, and occurs when the nutrient enrichment exceeds the self-purification capacity of streams and lakes (Yang *et al.*, 2000). Large quantities of these nutrients enter an aquatic environment. Sources of these nutrients include animal wastes, agricultural runoff, and sewage. The ecosystem quickly experiences an increase in photosynthetic and blue-green algae, as these organisms thrive in the presence of the added nutrients. An algae bloom occurs as the algae accumulates near the surface of the water, prohibiting light from penetrating deeper areas of lake or stream. At this point, oxygen-demanding bacteria take over the ecosystem, decomposing the algae and using up dissolved oxygen in the process. These bacteria increase the biological oxygen demand (BOD) of the ecosystem. BOD is the amount of oxygen required for the decomposition of organic compounds by microorganisms in a given amount of water. It is usually measured in milligrams of oxygen consumed per liter of water. BOD is important because it affects the amount of dissolved oxygen available to all species in an aquatic ecosystem. High BOD indicates a lower level of available dissolved oxygen in the water. This lower concentration of oxygen causes many fish to suffocate, and as they die, the number of oxygen-demanding decomposers increases even more.

Eutrophic waters are characterized by high nutrient concentrations, resulting in high productivity of plant growth. Such waters are often shallow, with algal blooms and periods of oxygen deficiency. Slightly or moderately eutrophic water can support a complex web of plant and animal life. However, such waters are generally undesirable for drinking water and other needs. Waters with extreme nutrient concentrations are called hypereutrophic (http://bcn.boulder.co.us/basin/data/NUTRIENTS/info/TP.html)

Eutrophication ranks with other major anthropogenic effects such as global warming, ozone layer depletion, and large-scale environmental disturbances, in relation to its potentially harmful effect on natural ecosystems (Cullen *et al*., 1997, Holligan, 1983, Marra *et al.,* 1992., ReVelle, 1988, Richerson *et al*., 1998, Scheffer, 1998, Smith *et al*., 1991). Eutrophication diminishes water quality by promoting the excessive growth of algae, cyanobacteria (blue-green algae) and macrophytes (Senayl *et al*., 2006). Eutrophicated water systems are characterized for their high algae population and turbidity. However, while this study is centered on the monitoring of total phosphorus in the San José Lagoon, based on reflectance signal, it must be recognized that the use of remote sensing to manage the eutrophication of freshwater systems also requires understanding of the distribution of phytoplankton species on both temporal and spatial scales (Ibrahim, 2006).

3.2.5.2 Reduction in Tidal Flushing Activity

During the mid 1930s, until early 1950s many communities were established on the banks of the Martín Peña Channel by filling its waters and wetlands with debris and other types of refuse (Sepúlveda-Rivera and Carbonell, 1989). The construction of structures on fill material significantly reduced the flow of water through this part of the estuary and reduced its capacity to store floodwaters. As a result, portions of the San Juan Bay National Estuary system may have less than adequate flushing characteristics to assimilate pollutant loadings. The San José Lagoon (4.6 km^2) is the innermost lagoon which is shallow (mean depth of 1.5 m) and has the least tidal fluctuation of 5-10 cm with the tidal range in San Juan Bay and La Torrecilla lagoon being about 60 cm. As a result the SJL experiences little tidal flushing (Bunch *et al.*, 2000). The Suárez channel, which connects the San José to La Torrecilla lagoon, is approximately 4 km long with widths ranging from greater than 30 m to less than 5 m where a major road crosses the canal. Depths of the Suárez channel range from as great as 10 m where dredging has taken place to less than 1 m at the narrow constriction. This constriction contributes to the reduced tidal range in the studied area (Bunch *et al*., 2000).

The narrow, shallow constriction along the eastern end of the Martín Peña channel, as shown in Figures 3-5 and 3-6, is due to sedimentation and debris and greatly impedes flushing of the studied lagoon. Such debris disposal practices have been employed by the residents for decades without adequate corrective and preventive actions adopted from the government. But the accumulation of debris in the San Juan Bay Estuary system seems to be more than just a solid waste management problem. Social issues, such as land squatting and land reclamation activities, also result in trash entering the estuary. For example, some of the residents along the Martín Peña Channel and the San José Lagoon are illegally filling wetland areas with garbage to transform and reclaim the land on the waterway (San Juan Bay Estuary Program, 2000).

FIGURE 3-5: EASTERN MARTÍN PEÑA CHANNEL (COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN, SAN JUAN BAY ESTUARY PROGRAM)

FIGURE 3-6: DEBRIS AT EASTERN MARTÍN PEÑA CHANNEL (COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN, SAN JUAN BAY ESTUARY PROGRAM)

As a result, the eastern portion of the Martín Peña channel and the SJL have the poorest water quality (Bunch *et al.,* 2000).

3.2.5.3 Baldorioty de Castro Stormwater and Los Corozos Raw Sewage Pumping Stations

Other pollution sources adjacent to the SJL are suspected to also be responsible for such water quality conditions.

FIGURE 3-7: BALDORIOTY DE CASTRO STORMWATER PUMPING STATION AND LOS COROZOS RAW SEWAGE PUMPING STATION (GOOGLE, 2008)

The Baldorioty de Castro Stormwater pumping station is located near the Los Corozos lagoon, as shown in Figure 3-7. Historical problems with the operation and maintenance of the Puerto Rico Aqueduct and Sewer Authority's (PRASA) sanitary sewer system include obstructions in sanitary sewer line, leading to system backups and overflows at manholes; infiltration of stormwater into the sanitary system, leading to overflows at manholes; the existence of combined or interconnected sewage and stormwater conveyances; and pumping station overflows. Among the most significant cases that have been reported are the overflows from PRASA's Los Corozos sewage pumping station into the Department of Natural and Environmental Resources' (DNER) Baldorioty de Castro stormwater pumping station. The Baldorioty de Castro stormwater pumping station, with an approximate maximum capacity of 300,000 gallons per minute produced by several pumping units, should only discharge stormwater and only operate during wet weather conditions. However, its discharges ranged over one million gallons per day of raw sewage into Los Corozos Lagoon on a frequent basis, mostly as a result of bypasses from the Los Corozos sewage pumping station (San Juan Bay Estuary Program, 2000).

The most significant changes in total phosphorus concentrations measured in samples collected from the water column during the past 20 years has been at the San José, La Torrecilla, and Piñones lagoons (Webb and Gómez-Gómez, 1996).

The decline in nutrient concentrations at La Torrecilla and Piñones lagoons can be related to the diversion in 1985 of wastewater discharged previously to Quebrada Blasina from the PRASA's Vistamar, Carolina, and Round Hills sewage treatment plants to regional wastewater treatment facilities that now discharge to ocean outfalls. While concentrations of nutrients in the surface waters sampled in Los Corozos lagoon were declining, the Baldorioty de Castro storm-water pumping station was observed to operate almost continuously, discharging contaminated waters into the area even during dry periods (Puerto Rico Environmental Quality Board, 1984).

3.2.5.4 Combined Sewer Overflows

Combined sewers transport both stormwater from the urbanized areas, and sewage originated from the dwellings surrounding the San Juan Bay National Estuary. During considerable rain events both polluted stormwater and sewage overflow the pipes or pumping stations and are diverted into surface waters. In addition to the surface water discharge by streams to the estuary system, there are discharges from urban "flood control" drainage pumps. A substantial volume of the raw sewage entering these stormwater sewers from residential and commercial interconnections is discharged into the estuary throughout the stormwater pumping stations. The DNER and the San Juan and Carolina municipalities manage a total of fourteen (14) stormwater pumping stations. These stations were designed to discharge stormwater only during wet weather conditions. However, some of these pumping stations need to be operated on a daily basis, partly due to incoming sewage from illegal connections. For example, stormwater pumping station in Santurce at Stop 18, with a pumping capacity of 175,000 gallons per minute, historically discharged raw sewage into the western half of the Martín Peña Channel (San Juan Bay Estuary Program, 2000). Combined sanitary and fluvial connections, and untreated sewage discharges caused direct impacts on the water quality and on the concentrations of pollutants within the water column and deposited in the sediments. In addition, Quebrada Blasina, which discharges into Laguna La Torrecilla, receives backwash from the Puerto Rico Aqueduct and Sewer Authority (PRASA) Sergio Cuevas Water Treatment Plant (Webb and Gómez-Gómez, 1996).

3.2.5.5 Illegal Sanitary Discharges

Illegal sanitary discharges have proliferated in the estuary watershed since housing development started in the 1930s. The housing was developed without the construction of basic utilities such as a sewage collection system, and, as a result, most of the structures discharge untreated sewage directly into the Martín Peña Channel or to the storm sewer system. In a study performed by the EQB from 1986 to 1989, almost 40 percent of the structures surveyed in the communities adjacent to the Martín Peña Channel were found to discharge their raw sewage into storm sewers or directly in the estuary or its tributaries (Junta de Calidad Ambiental, 1994).

Malfunctioning or inadequately designed on-site septic tanks also contribute to the eutrphication problem in the studied area, as untreated sewage overflows the septic unit and discharges to the surface water body. A major portion of the dwelling units, as shown in Figure 3-8, still discharges gray waters and have septic tanks constructed at the same, or at a lower receiving surface water elevation.

FIGURE 3-8: ILLEGAL WASTEWATER DISCHARGES TO THE SJBNE (COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN, SAN JUAN BAY ESTUARY PROGRAM)

3.2.5.6 Sediments Quality

The sediments in the San José lagoon have also been impacted by the increasing pollution reaching the estuary. Toxic materials, nutrients, heavy metals, erosion and sedimentation, and radioactive material are contaminants that have been contributed to the deterioration of the San José Lagoon sediments (San Juan Bay National Estuary Program, 2000). Sedimentation rates in the SJL are higher than in San Juan Bay due to the tidal circulation limitations and sediments accumulation in the Martín Peña channel originated from the Puerto Nuevo River (Webb and Gómez-Gómez, 1998a). Sediment contamination in the estuary is increased in areas with poor tidal flushing. The water and sediment quality of the bay, lagoons, and interconnecting natural and man-made channels has been significantly altered from its natural state not only by land-use activities, but also by modification of the hydraulic properties of the interconnecting waterways by dredging and placement of fill (Ellis, 1976; Seguinot-Barbosa, 1983).

3.2.5.7 Bottom Depressions

The San José and Los Corozos lagoons, and its connecting channels have experienced dredging and filling activities for several years for different purposes. In the past, the western and southwest portions of the San José lagoon received a significant quantity of fill material from the adjacent residential housing developments (San Juan Bay Estuary Program, 2000). Also, sedimentation and accumulated debris at the Martín Peña channel has created water exchange limitations between both lagoons and the San Juan Bay. There exist three pits excavated at the SJL and one pit at Los Corozos lagoons (Bailey *et al.*, 2004), as shown in Figure 3-9.

The Suárez channel was excavated in approximately 30 feet with the dredged material used as filling material for construction of marinas and residential developments. The deep dredging of the lagoons and the Suárez Channel has negatively impacted water quality. Dense salt or brackish water entering the lagoons flows underneath the fresh water discharged by streams and stormwater pumping stations (San Juan Bay Estuary Program, 2000). Such stratification impedes oxygen to be transferred from the water surface to the bottom of the pit.

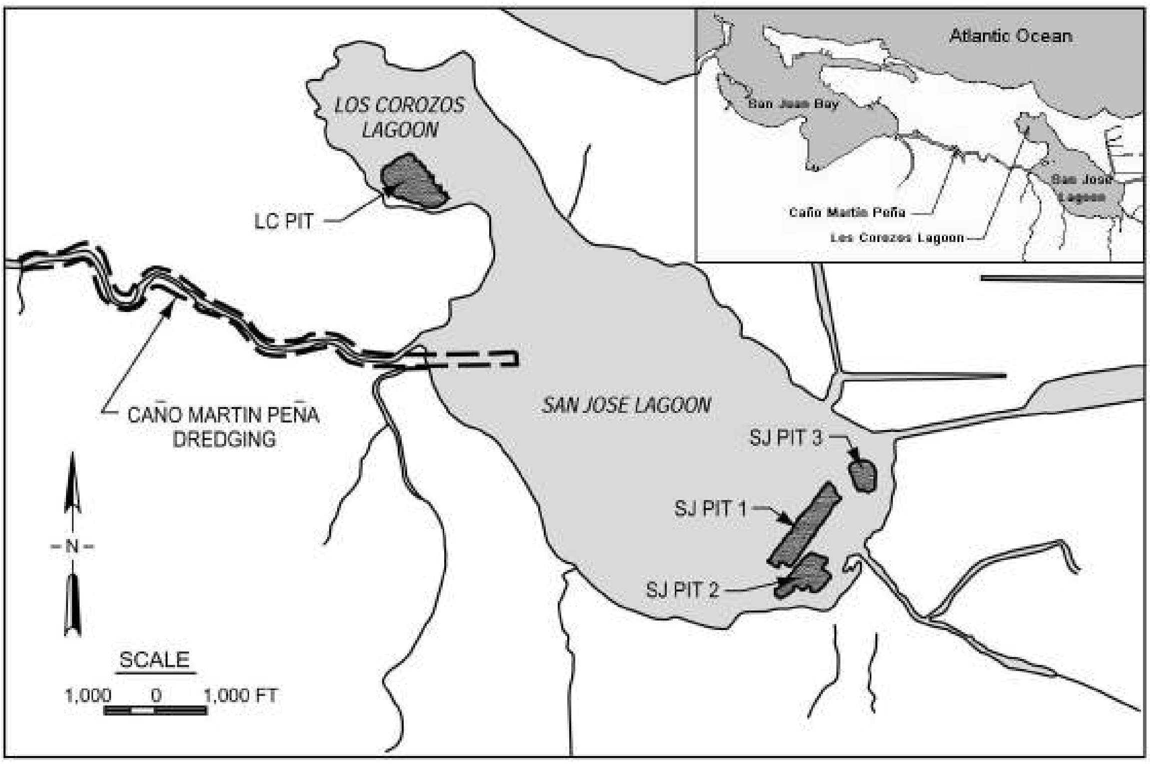

FIGURE 3-9 EXISTING PITS AT SJL AND LOS COROZOS LAGOON (BAILEY *et al.*, 2004)

Other lagoons have also been dredged for similar purposes. Borrow pits exist within Laguna del Condado, Laguna San José, and Laguna La Torrecilla where sand and fill mining occurred for the development of residential and service facilities, such as the Luis Muñoz Marín International Airport. The borrow pits are as deep as 10-18 m and are chemically stratified. Thus, the waters in the pits are low in dissolved oxygen and high in dissolved substances, including nutrients and chemical oxygen demand (Bunch *et al*, 2000).

3.2.5.8 Toxic Components

The United States Geological Survey (USGS) conducted a sampling survey at the San José lagoon during the period of 2002-2005 for several inorganic and heavy metals pollutants. The potentially toxic constituents identified are:

- Arsenic
- Barium
- Boron
- Cadmium
- Cyanide
- Coper
- Chromium
- Lead
- Selenium
- Mercury
- Silver
- Zinc

See Appendix H for results and section 6.4 for discussion of results and possible spectral interference with total phosphorus index.

4. CORP OF ENGINEER'S WATER QUALITY MODEL SIMULATION

This chapter analyses the water quality simulation performed by the United States Army Corp of Engineers (COE) at the San José lagoon (Bunch *et al*, 2000). Our research verifies the total phosphorus concentration obtained from the COE's model, with the results obtained from Hyperion images after application of an empirical algorithm. A water quality model simulation is not part of the research work.

4.1 BACKGROUND

In 2000 the COE developed a 3-dimensional (3D) hydrodynamic water quality model for the San José lagoon as part of the joint efforts by the San Juan Bay Estuary Program and EQB to evaluate alternatives to improve its quality conditions and to predict impacts of future developments (Bunch *et al.*, 2000)**.** The CH3D-WES (Curvilinear Hydrodynamics in 3-Dimensions – Waterways Experiment Station) is a time-varying three-dimensional numerical hydrodynamic, salinity, and temperature model. The water surface, 3-D velocity field, and 3-D salinity fields are computed. Major physical processes affecting circulation and vertical mixing of a large water body are modeled. The model solves the transformed equations on a boundary-fitted grid in both the horizontal and vertical planes. The horizontal grid is a general non-orthogonal curvilinear grid; the vertical grid is a sigma-stretched grid. The study conducted by the COE was comprised of the following activities: (1) bathymetric surveys; (2) hydrodynamic field data collection; (3) water quality data collection; and (4) hydrodynamic and water quality modeling. As part of our study the COE's model results were compared with the Hyperion transformed image results in predicting total phosphorus concentrations within the San José lagoon.

The 3D numerical hydrodynamic model, CH3D-WES (Curvilinear Hydrodynamics in 3 Dimensions, WES version), was used for the COE's study. The WES version of a former model (CH3D) was developed by Johnson *et al.,*1991. Physical processes in the model include tides, wind, density effects, freshwater inflows, turbulence, and the effect of the earth's rotation through the Coriolis effect.

The COE's tri-dimensional hydrodynamic model (HM) uses the CE-QUAL-ICM multi-dimensional water quality model (ICMWQM) (Cerco and Cole 1995). ICM uses a finite volume approach and was originally developed during a study of Chesapeake Bay. The WQM has multiple water quality state variables, including temperature, salinity, Dissolved Oxygen (DO), various forms of nitrogen, phosphorus, silica, and carbon, suspended solids, and phytoplankton. The model also includes a benthic sediment diagenesis submodel (DiToro and Fitzpatrick 1993) that simulates the decay and mineralization of bottom organic matter (e.g., settled algae) and the resulting nutrient and DO fluxes between the sediments and water column. The sediment diagenesis submodel dynamically couples sediment-water column interactions. For example, pollutant loading changes eventually affect sediment oxygen demand, which affects DO in the water column. Thus, this approach extends the credibility of the model for predicting future water quality. For the USCOE study, the ICMWQM included the following 16 state variables (Bunch *et al*., 2000):

· temperature

· salinity

· dissolved oxygen

· phytoplankton (one group)

· dissolved organic carbon

· particulate organic carbon

· particulate organic nitrogen

· dissolved organic nitrogen

· nitrate + nitrite nitrogen

· ammonium nitrogen

· particulate organic phosphorus

· dissolved organic phosphorus

· total inorganic phosphorus (with partitioning to dissolved and particulate phases)

· chemical oxygen demand (released from sediments)

· total suspended solids

· fecal coliform bacteria

The model simulated water quality concentrations for various management scenarios after both the HM and WQM were adjusted and calibrated, respectively, and after three months of data collection during 1995. The WQM simulations were repeated in successive runs were each run used results from the previous as initial conditions. Such process continued during eight months of water quality simulation time until the water quality parameters reached equilibrium conditions.

4.2 HYDRODYNAMIC MODEL (CH3D-WES)

The CH3D-WES model makes computations on a curvilinear boundary-fitted planform grid using curvilinear coordinates. Curvilinear coordinate system theory is discussed further in Section 4.2.1. Physical processes that are modeled which impact circulation and vertical mixing in a wide range of water bodies include tides, wind density effects (salinity, temperature, and suspended sediments), freshwater inflows, turbulence, and the effect of the earth's rotation. The boundary-fitted coordinate feature of the model in the horizontal dimensions provides grid resolution enhancement necessary to adequately represent navigation channels and irregular shoreline configurations of the water body (Bunch *et al*., 2000).

Before entering into the model details it is appropriate to explain various technical terms which will aid the reader to understand the mathematics involved in the model development and application.

4.2.1 Curvilinear Coordinate System

The curvilinear coordinates have the same number of coordinates as the rectangular coordinates and in order to be able to analyze them in this way there must be a continuous transform from rectangular coordinates. This transform must be reversible so that rectangular coordinates can be used. For a curvilinear coordinate system let u^1, u^2, u^3, as shown in Figure 4-1, represent the curvilinear coordinates of a point. The position of a point in curvilinear coordinates can be represented by P (u^1,u^2,u^3), in other words, a function of the coordinates. The point can also be represented by a function of the rectangular coordinates x, y and z denoted by P(x,y,z)

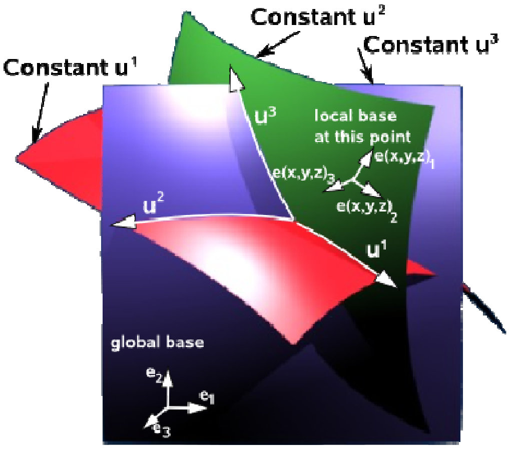

FIGURE 4-1: CURVILINEAR COORDINATES IN EUCLEDIAN PLANE
(http://www.euclideanspace.com/maths/geometry/space/coordinates/ curvilinear/index.htm)

In terms of rectangular coordinates we have:

$$P(x,y,z) = x\, e_1 + y\, e_2 + z\, e_3$$

A more complex function is used for curvilinear coordinates:

$$P(u^1,u^2,u^3) = X(u^1,u^2,u^3)\, e_1 + Y(u^1,u^2,u^3)\, e_2 + Z(u^1,u^2,u^3)\, e_3$$

For the linear case the coordinates can be expressed as a linear equation:

$$e_i\, A^i = e_1\, A^1 + e_2\, A^2 + e_3\, A^3 \ldots$$

For curvilinear coordinates either the basis or the components depend on the location:

$$e(x,y,z)_i\, A^i = e(x,y,z)_1\, A^1 + e(x,y,z)_2\, A^2 + e(x,y,z)_3\, A^3 \ldots$$

$$\text{or } e_i\, A(x,y,z)^i = e_1\, A(x,y,z)^1 + e_2\, A(x,y,z)^2 + e_3\, A(x,y,z)^3 \ldots$$

where:

e(x,y,z) is a basis which is a function of position.

A(x,y,z) are terms which are functions of position.

The coordinates can be made linear on the very small infinitesimal scale. In other words, the coordinates tend to become linear as the area tends to zero. In order to apply calculus concepts to resolve such dynamics, the coordinates must be linear on the very small infinitesimal scale.

Local basis vectors can be related to the global coordinate system by two methods:

- they can be built along the coordinate axes (axis-colinear) and the basis vectors transform like covariant vectors, or

- they can be built to be perpendicular (normal) to the coordinate surfaces then the basis vectors transform like contravariant vectors.

Covariance and contravariance refer to how coordinates change under a change of basis. Components of vectors transform contravariantly, while components of covectors (linear functionals) transform covariantly.

4.2.2 Contravariant Velocity Components

A normal vector to a coordinate surface on which the coordinate ξ is constant is given by $\nabla\xi$, as shown in Figure 4-2:

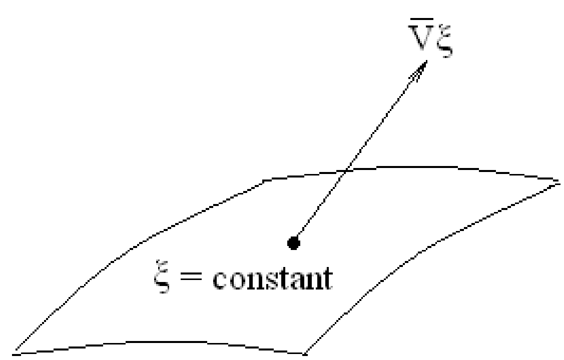

FIGURE 4-2: COORDINATE SURFACE AREA
(www.erc.msstate.edu/publications/gridbook/chap03/index.html

The normal vector $\nabla\xi$ is a contravariant base vector of the curvilinear coordinate system.

The three contravariant base vectors of the three coordinate surfaces are designated as:

$$a^i = \nabla \xi^i \quad i = (1,2,3) \tag{4-1}$$

Here the coordinate index i appear as a superscript on the base vector to differentiate these contravariant base vectors from the covariant base vectors. The two types of base vectors are illustrated in Figure 4-3, showing an element of volume with six sides, each of which lies on some coordinate surface.

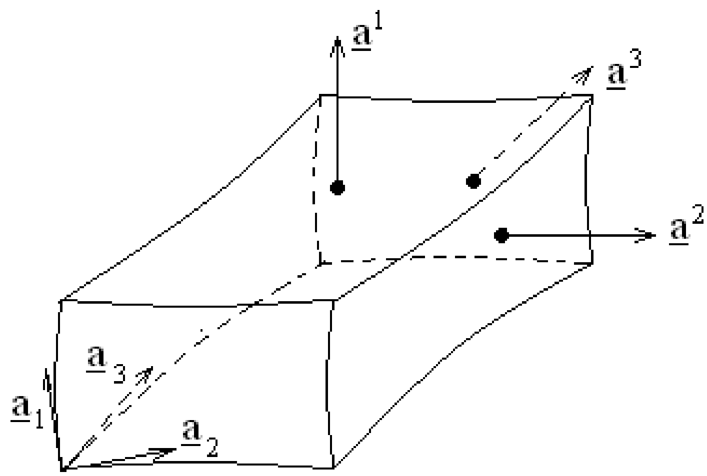

FIGURE 4-3: COVARIANT AND CONTRAVARIANT BASE VECTORS
(www.erc.msstate.edu/publications/gridbook/chap03/index.html)

Contravariant components of velocity vectors are employed in the derivation instead of the normal components in curvilinear coordinates or original components in Cartesian coordinates, which greatly simplifies the equations in generalized curvilinear coordinates (Shi *et al.*, 2001). The contravariant components of the velocity vector can be regarded as generalized components of velocity in the transformed image domain. Several advantages of using the contravariant velocity have been recognized in the derivations of hyperbolic-type equations, as shown by (Sheng, 1986), among others. Shi *et al.* (1997) introduced the contravariant components in their coordinate transformation of shallow water equations and easily obtained the kinematical lateral boundary conditions (i.e., the contravariant components of velocity are zero at boundaries). Furthermore, Shi *et al.*

(1998) derived a new set of equations for shallow waters equations in terms of contravariant velocity and surface elevation in order to solve the transformed equations by using an alternating-direction-implicit scheme.

4.2.3 Sigma Stretched Grid

The need to avoid misleading effects associated with representation of bathymetry and sidewall geometry suggests the use of a numerical grid which fits the irregular shape of the model domain. This has led in both meteorology and oceanography to classes of models with topography-following vertical and/or orthogonal curvilinear horizontal coordinates (See section 4.2.1). In these systems, coordinate transformations map the ocean (or atmosphere) to a rectangular computational domain. This ensures efficient use of computer resources, since all grid points lay within the fluid. The sigma coordinate was first introduced in atmospheric modeling (Phillips, 1957) and has since become a standard alternative in three-dimensional ocean modeling. Blumberg and Mellor (1987) and Haidvogel *et al* (1991) introduced a stretched coordinate usually referred to as sigma (for its previous usage in meteorology), defined as $\sigma = z/h$ where z is the position of the free surface (Cartesian height), and h is the fluid depth. This leads to boundary surfaces that can be put at $\sigma = 0,-1$ and an automatic accommodation of the depth contours. The sigma coordinate equations are obtained from a sigma coordinate system (Figure 4-4) and are based on the following transformation:

$$x^* = x, y^* = y, \sigma = \frac{z-\eta}{H+\eta}, t^* = t \tag{4-2}$$

where: x, y, z are the conventional Cartesian coordinates; $D = H + \eta$ where $H(x, y)$ is the bottom topography and $\eta(x, y, t)$ is the surface elevation, as shown in Figure 4-4. Thus, σ ranges from $\sigma = 0$ at $z = \eta$ to $\sigma = -1$ at $z = H$.

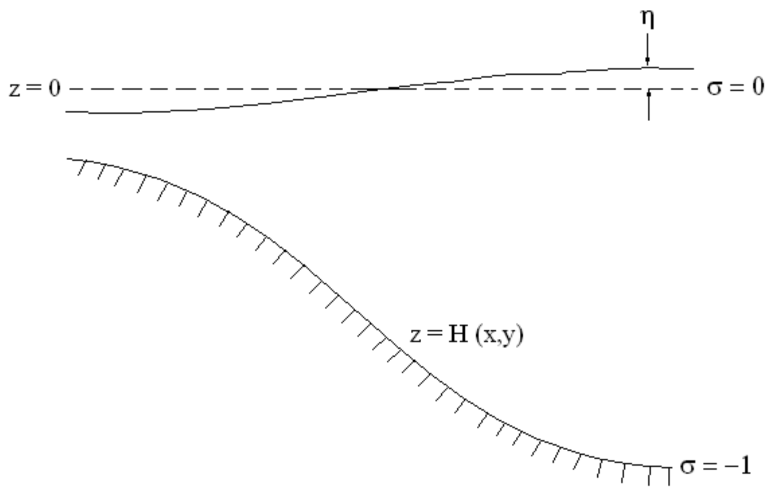

FIGURE 4-4: SIGMA COORDINATE SYSTEM (MELLOR, 2004)

The vertical topography-fitting transformation employed is:

$$Z \equiv s = s\left(\frac{z}{h}\right) \tag{4-3}$$

In the case of a linear relationship between s and z, the transformation is equivalent to the traditional sigma coordinate and the hydrostatic relation becomes

$$\frac{\partial p}{\partial s} = -gh\rho \tag{4-4}$$

where: $\frac{\partial p}{\partial s}$ = pressure gradient,

g = acceleration due to gravity,

h = water depth, and

ρ = fluid density.

4.2.4 Model Equations of Motion

A series of vertically averaged equations provide the solution for the free surface to the internal mode consisting of the full 3-D equations (Bunch *et al.*, 2000). The following sequence of equations has been extracted from the Hydrodynamic and Water Quality Model Study of the San Juan Bay Estuary, published by the COE in the year 2000.

The primitive equations in Cartesian Coordinates are:

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=0 \tag{4-5}$$

$$\begin{aligned}\frac{\partial u}{\partial t}+\frac{\partial u^2}{\partial x}+\frac{\partial uv}{\partial y}+\frac{\partial uw}{\partial z}=fv-\frac{1}{\rho}\frac{\partial p}{\partial x}+\frac{\partial}{\partial x}\left(A_H\frac{\partial v}{\partial x}\right)+\frac{\partial}{\partial y}\left(A_H\frac{\partial u}{\partial y}\right)\\+\frac{\partial}{\partial z}\left(A_V\frac{\partial u}{\partial z}\right)\end{aligned} \tag{4-6}$$

$$\begin{aligned}\frac{\partial v}{\partial t}+\frac{\partial uv}{\partial x}+\frac{\partial v^2}{\partial y}+\frac{\partial vw}{\partial z}=-fu\frac{1}{\rho}\frac{\partial p}{\partial y}+\frac{\partial}{\partial x}\left(A_H\frac{\partial v}{\partial x}\right)+\frac{\partial}{\partial y}\left(A_H\frac{\partial v}{\partial y}\right)\\+\frac{\partial}{\partial z}\left(A_V\frac{\partial y}{\partial z}\right)\end{aligned} \tag{4-7}$$

$$\frac{\partial p}{\partial z}=-\rho g \tag{4-8}$$

$$\begin{aligned}\frac{\partial T}{\partial t}+\frac{\partial uT}{\partial x}+\frac{\partial vT}{\partial y}+\frac{\partial wT}{\partial z}=\frac{\partial}{\partial x}\left(K_H\frac{\partial T}{\partial x}\right)+\frac{\partial}{\partial y}\left(K_H\frac{\partial T}{\partial y}\right)\\+\frac{\partial}{\partial z}\left(K_V\frac{\partial T}{\partial z}\right)\end{aligned} \tag{4-9}$$

$$\begin{aligned}\frac{\partial S}{\partial t}+\frac{\partial uS}{\partial x}+\frac{\partial vS}{\partial y}+\frac{\partial wS}{\partial z}=\frac{\partial}{\partial x}\left(K_H\frac{\partial S}{\partial x}\right)+\frac{\partial}{\partial y}\left(K_H\frac{\partial S}{\partial y}\right)\\+\frac{\partial}{\partial z}\left(K_V\frac{\partial S}{\partial z}\right)\end{aligned} \tag{4-10}$$

$$\rho = \rho(T, S) \tag{4-11}$$

where:

(u, v, w) = velocities in x, y, z directions

t = time

f = Coriolis parameter

= 2Ωsin ϕ where Ω is the rotational speed of the earth and ϕ = latitude (4-12)

The rotation speed of the Earth (7.2921 $\times 10^{-5}$ rad/s) can be calculated as 2π / *T* rad/s, where *T* is the rotation period of the Earth which is one *sidereal* day (23 hr 56 m 4.1 s). Inertial oscillations on the surface of the earth have this frequency. These oscillations are the result of the Coriolis effect.

ρ = density

p = pressure

A_H, K_H = horizontal turbulent eddy coefficients

Av, Kv = vertical turbulent eddy coefficients

g = gravitational acceleration

T = temperature

S = salinity.

The model equations use dimensionless variables for convenience purposes:

$$(u^*, v^*, w^*) = (u, v, w, X_R / Z_R) / U_R \tag{4-13}$$

$$(x^*, y^*, z^*) = (x, y, z, X_R / Z_R) / X_R \tag{4-14}$$

$$(\tau_x^*, \tau_y^*) = (\tau_x^w, \tau_y^w) / \rho_o f Z_r U_r \tag{4-15}$$

$$t^* = tf \tag{4-16}$$

$$\zeta^* = g\zeta / fU_r X_r = \zeta / S_r \tag{4-17}$$

$$\rho^* = (\rho - \rho_o)/(\rho_t - \rho_o) \tag{4-18}$$

$$T^* = (T - T_o)/(T_r - T_o) \tag{4-19}$$

$$A_H^* = A_H / A_{Hr} \tag{4-20}$$

$$A_V^* = A_V / A_{Vr} \tag{4-21}$$

$$K_H^* = K_H / K_{Hr} \tag{4-22}$$

$$K_V^* = K_V / K_{Vr} \tag{4-23}$$

where:

$(\tau_x^w, \tau_y^w) =$ wind stress in x-, y- directions

$\zeta =$ water surface elevation

$\rho_o, T_o =$ typical values for the water density and temperature

and S_r, T_r, U_r, ρ_r, X_r Z_r, A_{Hr}, A_{Vr}, K_{Hr}, and K_{Vr} are arbitrary reference values of the salinity, temperature, velocity, density, horizontal dimension, vertical dimension, horizontal viscosity, vertical viscosity, horizontal diffusion, and vertical diffusion, respectively.

The following dimensionless parameters yield:

Vertical Ekman Number:

$$E_v = A_{vr} / fZ_r^2 \tag{4-24}$$

Lateral Ekman Number:

$$E_H = A_{Hr} / fX_r^2 \tag{4-25}$$

Vertical Prandtl Number:

$$Pr_H = A_{vr} / K_{vr} \tag{4-26}$$

Lateral Prandtl Number:

$$Pr_H = A_{Hr} / K_{Hr} \tag{4-27}$$

Froude Number:

$$Fr = \sqrt{gZ_r} \tag{4-28}$$

Rossby Number:

$$R_o = U_r / fX_r \tag{4-29}$$

Densimetric Rossby Number:

$$Fr_D = F_r / \sqrt{\in} \tag{4-30}$$

where:

$$\in = (\rho_r - \rho_o) / \rho_o \tag{4-31}$$

4.2.5 Vertically Integrated Equations

The equations, governing the dynamics of coastal circulation, contain fast moving external gravity waves and slow moving internal gravity waves. It is desirable in terms of computer economy to separate the vertically integrated equations (external mode) from the vertical structure equations (internal mode) (Mellor, 2004).

The equations of motion are integrated over the depth to produce a set of vertically integrated for the water surface, ζ , and unit flow rates U and V in the x- and y-directions.

The external mode equations are as follows:

$$\frac{\partial \zeta}{\partial t} + \beta\left(\frac{\partial U}{\partial x} + \frac{\partial V}{\partial y}\right) = 0 \tag{4-32}$$

$$\begin{aligned}\frac{\partial U}{\partial t} &= -H\frac{\partial \zeta}{\partial x} + \tau_{sx} - \tau_{bx} + V - R_o\left[\frac{\partial}{\partial x}\left(\frac{UU}{H}\right) + \frac{\partial}{\partial y}\left(\frac{UV}{H}\right)\right] \\ &+ E_H\left[\frac{\partial}{\partial x}\left(A_H\frac{\partial U}{\partial x}\right) + \frac{\partial}{\partial y}\left(A_H\frac{\partial U}{\partial y}\right)\right] - \frac{R_o}{Fr_D^2}\frac{H^2}{2}\frac{\partial \rho}{\partial x}\end{aligned} \tag{4-33}$$

$$\begin{aligned}\frac{\partial V}{\partial t} &= -H\frac{\partial \zeta}{\partial y} + \tau_{sy} - \tau_{by} - U - R_o\left[\frac{\partial}{\partial x}\left(\frac{UV}{H}\right) + \frac{\partial}{\partial y}\left(\frac{VV}{H}\right)\right] \\ &+ E_H\left[\frac{\partial}{\partial x}\left(A_H\frac{\partial V}{\partial x}\right) + \frac{\partial}{\partial y}\left(A_H\frac{\partial V}{\partial y}\right)\right] - \frac{R_o}{Fr_D^2}\frac{H^2}{2}\frac{\partial \rho}{\partial y}\end{aligned} \tag{4-34}$$

where:

$$\beta = gZ_r / f^2 X_r^2 = \left(\frac{R_o}{F_r}\right)^2 \tag{4-35}$$

$H =$ total depth.

$\tau_s, \tau_b =$ surface and bottom shear stresses

The dimensionless form of the internal mode equations from which the 3-D velocity, salinity, and temperature fields are computed are:

$$\begin{aligned}\frac{\partial hu}{\partial t} &= -h\frac{\partial \zeta}{\partial x} + E_v\frac{\partial}{\partial z}\left(A_v\frac{\partial hu}{\partial z}\right) + hv - R_o\left(\frac{\partial huu}{\partial x} + \frac{\partial huv}{\partial y} + \frac{\partial huw}{\partial z}\right) + \\ &E_H\left[\frac{\partial}{\partial x}\left(A_H\frac{\partial hu}{\partial x}\right) + \frac{\partial}{\partial y}\left(A_H\frac{\partial hu}{\partial y}\right)\right] - \frac{R_o}{Fr_D^2}\left(\int_z^\zeta \frac{\partial \rho}{\partial x}dz\right)\end{aligned} \tag{4-36}$$

$$\begin{aligned}\frac{\partial hv}{\partial t} &= -h\frac{\partial \zeta}{\partial y} + E_v\frac{\partial}{\partial z}\left(A_v\frac{\partial hv}{\partial z}\right) - hu - R_o\left(\frac{\partial hvu}{\partial x} + \frac{\partial hvv}{\partial y} + \frac{\partial hvw}{\partial z}\right) \\ &+ E_H\left[\frac{\partial}{\partial x}\left(A_H\frac{\partial hv}{\partial x}\right) + \frac{\partial}{\partial y}\left(A_H\frac{\partial hv}{\partial y}\right)\right] - \frac{R_o}{Fr_D^2}\left(\int_z^\zeta \frac{\partial \rho}{\partial y}dz\right)\end{aligned} \tag{4-37}$$

$$w_{k+½} = w_{k-½} - \left(\frac{\partial uh}{\partial x} + \frac{\partial vh}{\partial y} \right)$$

$$\begin{aligned} \frac{\partial hT}{\partial t} &= \frac{E_v}{Pr_v} \frac{\partial}{\partial z}\left(K_v \frac{\partial T}{\partial z} \right) - R_o \left(\frac{\partial huT}{\partial x} + \frac{\partial hvT}{\partial y} + \frac{\partial hwT}{\partial z} \right) \\ &+ \frac{E_H}{Pr_H} \left[\frac{\partial}{\partial x}\left(K_H \frac{\partial hT}{\partial x} \right) + \frac{\partial}{\partial y}\left(K_H \frac{\partial hT}{\partial y} \right) \right] \end{aligned} \quad (4\text{-}38)$$

$$\begin{aligned} \frac{\partial hS}{\partial t} &= \frac{E_v}{Pr_v} \frac{\partial}{\partial z}\left(K_v \frac{\partial S}{\partial z} \right) - R_o \left(\frac{\partial huS}{\partial x} + \frac{\partial hvS}{\partial y} + \frac{\partial hwS}{\partial z} \right) \\ &+ \frac{E_H}{Pr_H} \left[\frac{\partial}{\partial x}\left(K_H \frac{\partial hS}{\partial x} \right) + \frac{\partial}{\partial y}\left(K_H \frac{\partial hS}{\partial y} \right) \right] \end{aligned} \quad (4\text{-}39)$$

In these equations *h* is the thickness of an internal layer, w is the vertical component of the velocity, and *k*+1/2 and *k*-1/2 represent the top and bottom, respectively, of the k^{th} vertical layer.

4.2.6 Boundary-Fitted Equations

The CHD3-WES makes computations on a boundary-fitted or generalized curvilinear planform grid. Thus, boundary-fitted coordinates (ξ,η) are used obtaining a system of equations for vertically averaged flow fields. However, in CH3D-WES not only are the x- and y-coordinates transformed into the (ξ,η) curvilinear system, but also the velocity is transformed such that its components are perpendicular to the (ξ,η) coordinate lines. This is accomplished by employing the following definitions for the components of the Cartesian velocity (*u, v*) in terms of contravariant components $\overline{u}$ and $\overline{v}$:

$$u = x_\xi \overline{u} + x_\eta \overline{v} \quad (4\text{-}40)$$

$$v = y_\xi \bar{u} + y_\eta \bar{v} \tag{4-41}$$

The Cartesian derivatives are replaced with the following equations:

$$f_x = \frac{1}{J}\left[\left(fy_\eta\right)_\xi - \left(fy_\xi\right)_\eta\right] \tag{4-42}$$

$$f_y = \frac{1}{J}\left[-\left(fx_n\right)_\xi + \left(fx_\xi\right)_\eta\right] \tag{4-43}$$

Where J is the Jacobian of the transformation:

$$J = x_\xi y_\eta - x_\eta y_\xi \tag{4-44}$$

The dimensionless basic equations written in contravariant velocity components and the boundary conditions are defined on a boundary-fitted grid similarly to a Cartesian grid since $\bar{u}$ and $\bar{v}$ are perpendicular to the cell faces, in other words, both $\bar{u}$ and $\bar{v}$ are zero at a land boundary. The model defines vertical dimensions with a sigma-stretched grid, and since bottom layer of a water column interacts with a bottom layer of adjacent column channel stratification is not possible. The following boundary-fitted equations for $\bar{u}$, $\bar{v}$, w, S, and T, have Cartesian coordinates and Cartesian velocity components transformed, and are used by the model for each vertical layer. These equations are the model solutions in the z-plane and represent the internal mode:

$$\begin{aligned}
\frac{\partial h\bar{u}}{\partial t} = & -h\left(\frac{G_{22}}{J^2}\frac{\partial \zeta}{\partial \xi} - \frac{G_{12}}{J^2}\frac{\partial \zeta}{\partial \eta}\right) + \frac{h}{J}\left(G_{12}\bar{u} + G_{22}\bar{v}\right) + \frac{R_o x_\eta}{J^2}\left[\begin{array}{l}\frac{\partial}{\partial \xi}\left(Jy_\xi h\overline{\bar{u}\bar{u}} + Jy_\eta h\overline{\bar{u}\bar{v}}\right)\\ +\frac{\partial}{\partial \eta}\left(Jy_\xi h\overline{\bar{u}\bar{v}} + Jy_\eta h\overline{\bar{v}\bar{v}}\right)\end{array}\right] \\
& -\frac{R_o y_\eta}{J^2}\left[\frac{\partial}{\partial_\eta}\left(Jx_\xi h\overline{\bar{u}\bar{u}} + Jx_\eta h\overline{\bar{u}\bar{v}}\right) + \frac{\partial}{\partial_\eta}\left(Jx_\xi h\overline{\bar{u}\bar{v}} + Jx_\eta h\overline{\bar{v}\bar{v}}\right)\right] - R_o\left[\left(w\bar{u}\right)_{top} - \left(w\bar{u}\right)_{bot}\right] \\
& + E_v\left[\left(A_v\frac{\partial \bar{u}}{\partial z}\right)_{top} - \left(A_v\frac{\partial \bar{u}}{\partial z}\right)_{bot}\right] - \frac{R_o h}{Fr_D^2}\left[\int_Z^\varsigma \left(\frac{G_{22}}{J^2}\frac{\partial \rho}{\partial \xi} - \frac{G_{12}}{J^2}\frac{\partial \rho}{\partial \eta}\right)dz\right] + Horizontal\ Diff.
\end{aligned} \tag{4-45}$$

The Jacobian of a transformation $x = g(u,v),\ y = h(u,v)$ is: $\frac{\partial(x,y)}{\partial(u,v)} = \begin{vmatrix} \frac{\partial x}{\partial u} & \frac{\partial x}{\partial v} \\ \frac{\partial y}{\partial v} & \frac{\partial y}{\partial v} \end{vmatrix}$

is resolved as a determinant.

$$\frac{\partial h\bar{v}}{\partial t} = -h\left(-\frac{G_{21}}{J^2}\frac{\partial \zeta}{\partial \xi} + \frac{G_{11}}{J^2}\frac{\partial \zeta}{\partial \eta}\right) - \frac{h}{J}\left(G_{11}\bar{u} + G_{21}\bar{v}\right) - \frac{R_o x_\eta}{J^2}\left[\frac{\partial}{\partial \xi}\left(Jy_\xi h\overline{uu} + Jy_\eta h\overline{uv}\right) + \frac{\partial}{\partial \eta}\left(Jy_\xi h\overline{uv} + Jy_\eta h\overline{vv}\right)\right]$$

$$+\frac{R_o y_\eta}{J^2}\left[\frac{\partial}{\partial_\eta}\left(Jx_\xi h\overline{uu} + Jx_\eta h\overline{uv}\right) + \frac{\partial}{\partial_\eta}\left(Jx_\xi h\overline{uv} + Jx_\eta h\overline{vv}\right)\right] - R_o\left[(w\bar{v})_{top} - (w\bar{v})_{bot}\right] + E_v\left[\left(A_v\frac{\partial \bar{v}}{\partial z}\right)_{top} - \left(A_v\frac{\partial \bar{v}}{\partial z}\right)_{bot}\right]$$

$$-\frac{R_o h}{Fr_D^2}\left[\int_z^\zeta \left(\frac{G_{21}}{J^2}\frac{\partial \rho}{\partial \xi} - \frac{G_{11}}{J^2}\frac{\partial \rho}{\partial \eta}\right) dz\right] + Horizontal\ Diffusion \qquad (4\text{-}46)$$

$$w_{top} = w_{bot} - \frac{1}{J}\left(\frac{\partial J\bar{u}h}{\partial \xi} + \frac{\partial J\bar{v}h}{\partial \eta}\right) \qquad (4\text{-}47)$$

$$\frac{\partial hS}{\partial t} = \frac{E_v}{Pr_v}\left[\left(K_v\frac{\partial S}{\partial z}\right)_{top} - \left(K_v\frac{\partial S}{\partial z}\right)_{bot}\right] - \frac{R_o}{J}\left(\frac{\partial hJ\bar{u}S}{\partial \xi} + \frac{\partial hJ\bar{v}S}{\partial \eta}\right) - R_o\left[(wS)_{top} - (wS)_{bot}\right]$$

(4-48)

$$+Horizontal\ Diffusion$$

$$\frac{\partial hT}{\partial t} = \frac{E_v}{Pr_v}\left[\left(K_v\frac{\partial T}{\partial z}\right)_{top} - \left(K_v\frac{\partial T}{\partial z}\right)_{bot}\right] - \frac{R_o}{J}\left(\frac{\partial hJ\bar{u}T}{\partial \xi} + \frac{\partial hJ\bar{v}T}{\partial \eta}\right) - R_o\left[(wT)_{top} - (wT)_{bot}\right]$$

(4-49)

$$+Horizontal\ Diffusion$$

where:

$$G_{11} = x_\xi^2 + y_\xi^2 \qquad (4\text{-}50)$$

$$G_{22} = x_\eta^2 + y_\eta^2 \qquad (4\text{-}51)$$

$$G_{12} = G_{21} = x_\xi x_\eta + y_\xi y_\eta \qquad (4\text{-}52)$$

The external mode equations are as follows:

$$\frac{\partial \zeta}{\partial t} + \beta\left(\frac{\partial \overline{U}}{\partial \xi} + \frac{\partial \overline{V}}{\partial \eta}\right) = 0 \tag{4-53}$$

$$\frac{\partial \overline{U}}{\partial t} = -\frac{H}{J^2}\left(G_{22}\frac{\partial \zeta}{\partial \xi} - G_{12}\frac{\partial \zeta}{\partial \eta}\right) + \frac{1}{J}\left(G_{12}\overline{U} + G_{22}\overline{V}\right) + \frac{R_o x_\eta}{J^2 H}\begin{bmatrix}\frac{\partial}{\partial \xi}\left(Jy_\xi \overline{UU} + Jy_\eta \overline{UV}\right) \\ +\frac{\partial}{\partial \eta}\left(Jy_\xi \overline{UV} + Jy_\eta \overline{VV}\right)\end{bmatrix} - \frac{R_o y_\eta}{J^2}\begin{bmatrix}\frac{\partial}{\partial \xi}\left(Jx_\xi \overline{UU} + Jx_\eta \overline{UV}\right) \\ +\frac{\partial}{\partial_\eta}\left(Jx_\xi \overline{UV} + Jx_\eta \overline{VV}\right)\end{bmatrix} \tag{4-54}$$

$$+\tau_{s\xi} - \tau_{b\xi} - \frac{R_o}{F r_D^2}\frac{H^2}{2}\left(G_{22}\frac{\partial \rho}{\partial \xi} - G_{12}\frac{\partial \rho}{\partial \eta}\right) + Horizontal\,Diffusion$$

$$\frac{\partial \overline{V}}{\partial t} = -\frac{H}{J^2}\left(-G_{21}\frac{\partial \zeta}{\partial \xi} - G_{11}\frac{\partial \zeta}{\partial \eta}\right) + \frac{1}{J}\left(G_{11}\overline{U} + G_{21}\overline{V}\right) - \frac{R_o x_\xi}{J^2 H}\left[\frac{\partial}{\partial \xi}\left(Jy_\xi \overline{UU} + Jy_\eta \overline{UV}\right) + \frac{\partial}{\partial \eta}\left(Jy_\xi \overline{UV} + Jy_\eta \overline{VV}\right)\right]$$

$$+\frac{R_o y_\xi}{J^2}\left[\frac{\partial}{\partial \xi}\left(Jx_\xi \overline{UU} + Jx_\eta \overline{UV}\right) + \frac{\partial}{\partial_\eta}\left(Jx_\xi \overline{UV} + Jx_\eta \overline{VV}\right)\right] + \tau_{s\eta} - \tau_{b\eta} - \frac{R_o}{F r_D^2}\frac{H^2}{2}\left(G_{21}\frac{\partial \rho}{\partial \xi} - G_{11}\frac{\partial \rho}{\partial \eta}\right) \tag{4-55}$$

$$+Horizontal\ Diffusion$$

where $\overline{U}$ and $\overline{V}$ are contravariant components of the vertically average velocity. The model resolves the external mode equations to obtain the surface-water elevation, which yield the water surface slope in terms of the internal mode equations.

4.2.7 Numerical Solution Algorithm

The model uses finite differences to resolve the equations in the internal and external modes. A staggered grid is defined in the horizontal and vertical directions. Horizontally, a unit cell is formed consisting of a $\zeta -$point in the center $\zeta(i, j)$, a U-point on its left face $\left(U_{i,j}\right)$, and a V-point on its bottom face $\left(V_{i,j}\right)$. Vertical velocities are then estimated in the "full" grid. Horizontal velocities, temperature, salinity, and density are estimated at the "half" grid points. The external mode solution consists on the surface displacement and vertically integrated contravariant unit flows $\overline{U}$ and $\overline{V}$. The resulting finite differences equations are then factored such that a $\xi-$sweep followed by a $\eta-$ sweep of the horizontal grid yields the solution at the new time-step:

$$\frac{\partial\zeta}{\partial t}+\beta\left(\frac{\partial\overline{U}}{\partial\xi}+\frac{\partial\overline{V}}{\partial\eta}\right)=0 \tag{4-56}$$

$$\frac{\partial\overline{U}}{\partial t}+\frac{H}{J^2}G_{22}\frac{\partial\zeta}{\partial\eta}=M \tag{4-57}$$

$$\frac{\partial\overline{V}}{\partial t}+\frac{H}{J^2}G_{11}\frac{\partial\zeta}{\partial\eta}=N \tag{4-58}$$

Where *M* and *N* are the remaining terms of equations 4-56 and 4-57, the $\xi-$ sweep is:

$$\xi-\text{sweep}\rightarrow\zeta_{ij}^{*}+\frac{\beta\theta\Delta t}{\Delta\xi}\left(\overline{U}_{i+1,j}^{*}-\overline{U}_{i,j}^{*}\right) \tag{4-59}$$

$$=\zeta_{ij}^{n}(1-\theta)\frac{\Delta t}{\Delta\xi}\left(\overline{U}_{i+1,j}^{n}-\overline{U}_{i,j}^{n}\right)\frac{\Delta t}{\Delta\eta}\left(\overline{V}_{i+1,j}^{n}-\overline{V}_{i,j}^{n}\right) \tag{4-60}$$

where θ is the parameter which determines the degree of implicitness

$$\overline{U}_{i,j}^{n+1}+\frac{\theta\Delta tHG_{22}}{\Delta\xi J^2}\left(\zeta_{i,j}^{*}-\zeta_{i-1,j}^{*}\right)=\overline{U}_{i,j}^{n}-(1-\theta)\frac{\theta\Delta tHG_{22}}{\Delta\xi J^2}\left(\zeta_{i,j}^{n}-\zeta_{i-1,j}^{n}\right)+\Delta tM^{n} \tag{4-61}$$

The $\eta-$sweep provides the updated ζ and $\overline{V}$ at the $n+1$ time level.

$$\eta-\text{ sweep}\rightarrow\zeta_{ij}^{n+1}+\frac{\beta\theta\Delta t}{\Delta\eta}\left(\overline{V}_{i+1,j}^{n+1}-\overline{V}_{i,j}^{n}\right)=\zeta_{i,j}^{*}-(1-\theta)\frac{\Delta t}{\Delta\eta}\left(\overline{V}_{i,j+1}^{n+1}-\overline{V}_{i,j}^{n}\right) \tag{4-62}$$

and

$$\overline{V}_{i,j}^{n+1}+\frac{\theta\Delta tHG_{11}}{\Delta\eta J^2}\left(\zeta_{i,j+1}^{n+1}-{}_{i,j}^{n+1}\right)=\overline{V}_{i,j}^{n}-(1-\theta)\frac{\Delta tHG_{11}}{\Delta\eta J^2}\left(\zeta_{i,j+1}^{n}-\zeta_{i,j}^{n}\right)+\Delta tN^{n} \tag{4-63}$$

A typical value of θ = 0.55 yields stable and accurate solutions. The internal mode consists of computations from Equations 4-45 to 4-52 for the three velocity components, and *w*, salinity, and temperature. The same time-step size is used for both internal and external modes. The only terms treated implicitly are the vertical diffusion terms in all equations and the bottom friction and surface slope terms in the momentum equations. Values of the water-surface elevations from the external mode are used to evaluate the surface slope terms in Equations 4-45 and 4-46. As a result, the extremely restrictive speed of a free-surface gravity wave is removed from the stability criteria. Roache's second upwind differencing is used to represent the convective terms in the momentum equations, whereas a spatially third-order scheme developed by Leonard (1979) called QUICKEST is used to represent the advective terms in Equations 4-48 and 4-52 for salinity and temperature, respectively. For example, if the velocity on the right face of a computational cell is positive, then with QUICKEST the value of the salinity used to compute the flux through the face is:

$$S_r = \frac{1}{2}\left(S_{i,j.k} + S_{i+1,j,k}\right) - \frac{1}{6}\left[1 - \left(\frac{\overline{U}_{i+1,j,k}\Delta t}{\Delta\xi}\right)^2\right]\left(S_{i+1,j,k} - 2S_{i,j,k} + S_{i-1,j,k}\right)$$
$$-\frac{1}{2}\frac{U_{i+1,j,k}\Delta t}{\Delta\xi}\left(S_{i+1,j,k} - S_{i,j,k}\right) \tag{4-64}$$

4.2.8 Boundary Conditions

The boundary conditions at the top are:

$$A_V\left(\frac{\partial\overline{u}}{\partial z}, \frac{\partial\overline{v}}{\partial z}\right) = \left(\tau_{s\xi}, \tau_{s\eta}\right)/\rho = \left(CW_\xi^2, CW_\eta^2\right) \tag{4-65}$$

$$\frac{\partial T}{\partial z} = \frac{Pr}{E_v}K\left(T - T_e\right) \tag{4-66}$$

$$\frac{\partial S}{\partial z} = 0 \tag{4-67}$$

The boundary conditions at the bottom are:

$$A_v\left(\frac{\partial \bar{u}}{\partial z}, \frac{\partial \bar{v}}{\partial z}\right) = \left(\tau_{b\xi}, \tau_{b\eta}\right)/\rho = \frac{U_r}{A_{vr}} Z_r C_d \left(u_1^{-2}, v_1^{-2}\right)^{\frac{1}{2}} \left(\bar{u}_1, \bar{v}_1\right) \tag{4-68}$$

$$\frac{\partial T}{\partial z} = 0 \tag{4-70}$$

$$\frac{\partial S}{\partial z} = 0 \tag{4-71}$$

where:

C = surface drag coefficient

W = wind speed

K = surface heat exchange coefficient

T_e = equilibrium temperature

C_d = bottom friction coefficient

$\bar{u}_1, \bar{v}_1$ = values of the horizontal velocity next to the bottom.

With z_1 equal to one-half the bottom layer thickness, C_d is given by

$$C_d = k^2 \left[\ln\left(z_1 / z_o\right)\right]^{-2} \tag{4-72}$$

where:

k = von Karman constant

z_o = bottom roughness height

4.2.9 Initial Conditions

At the start of a model run, the values of ζ, u, v, w, U, and V were all set to zero. Values of the salinity and temperature are read from input files. These initial fields are generated from known data at a limited number of locations. Once the values in individual cells are determined by interpolating from the field data, the resulting 3-D field is smoothed several times. Generally, the salinity and temperature fields are frozen for the first few days of a simulation.

4.3 WATER QUALITY MODEL (CE-QUAL-ICM)

4.3.1 Introduction

The CE-QUAL-ICM was designed to be a flexible, widely-applicable eutrophication model. The model, coded in ANSI Standard FORTRAN 77, was originally developed for Chesapeake Bay (Cerco and Cole, 1994). ICM stands for "integrated compartment model," which is analogous to the finite volume numerical method. Application of CE-QUAL-ICM requires transport information from a hydrodynamic model, which for the San José lagoon will be the CH3D-WES. The model computes constituent concentrations resulting from transport and transformations in well-mixed cells that can be arranged in arbitrary one-, two-, or three-dimensional configurations. Thus, the model employs an unstructured grid system. The model kinetics is, in this case, applied to the San Juan Bay Estuary.

4.3.2 Model Features

Features of the model include: Operational in one- two- or three-dimensional configurations. Twenty-seven state variables including physical properties; multiple forms of algae, zooplankton, carbon, nitrogen, phosphorus, and silica; dissolved oxygen; and a pathogen and two toxicants. Living resources including submerged aquatic vegetation, benthic filter feeders, and benthic deposit feeders were also considered as part of the model. Sediment-water oxygen and nutrient fluxes may be computed in a predictive submodel or specified based on observations. State variables may be individually activated or deactivated. Internal averaging of model output over arbitrary intervals. Computation and reporting of concentrations, mass transport, kinetics transformations, and mass balances. Debugging aids include ability to activate or deactivate model features, diagnostic output, volumetric and mass balances.

4.3.3 Model Limitations

The model does not compute hydrodynamics. Flows, diffusion coefficients, and volumes must be specified externally and read into the model. Hydrodynamics may be specified in binary or ASCII format. Hydrodynamics are usually obtained from a hydrodynamics model such as the CH3D-WES model (Johnson *et al*., 1991).

4.3.4 Model Structure

The model consists of a main program, an INCLUDE file, and subroutines. Both main program and subroutines perform read and write operations on numerous input and output files.

5. PROCEDURES AND METHODOLOGY

This research included several activities that are summarized in Figure 5-1. The following sections describe the performed procedures and methods in such activities.

5.1 Raw Hyperion Images Radiometric Correction

Seasonal raw images were obtained with the Hyperion hyperspectral sensor directed at the San José Lagoon during February, 2006, May, 2006, and August, 2006. All Hyperion images used in this research were radiometrically corrected by the USGS at the Level 1R format (http://eo1.usgs.gov/userGuide/index.php?page=hyp_process). These Level 1R raw images from the SJL were produced on February, May, and August 2006 were obtained and processed with the ENVI 4.2® software developed by RSI (now known as ITT Visual Information Solutions), as shown in Figures 5-2 to 5-4. The USGS uses different algorithms to perform corrections to the raw spectral image obtained from the Hyperion and also radiometrically calibrates it at Level 0. In such procedure the USGS removes smear and echo produced by the raw image pixels which affects the short-wave infrared (SWIR) bands. Following the pre Level 1R corrections a bias is developed from pre-image and post-image dark files, and substracted from echo and smear corrected file. The image is then radiometrically calibrated and the visible near infrared (VNIR) and SWIR bands are rescaled to obtain digital values. The raw product has a total of 242 bands of which only 198can be calibrated. These are from channels 8-57 for the VNIR, and from 77-224 in the SWIR bands. Bands that are not calibrated receive a digital value of 0. Finally, the bad pixels identified by the Hyperion sensor are flag masked and the

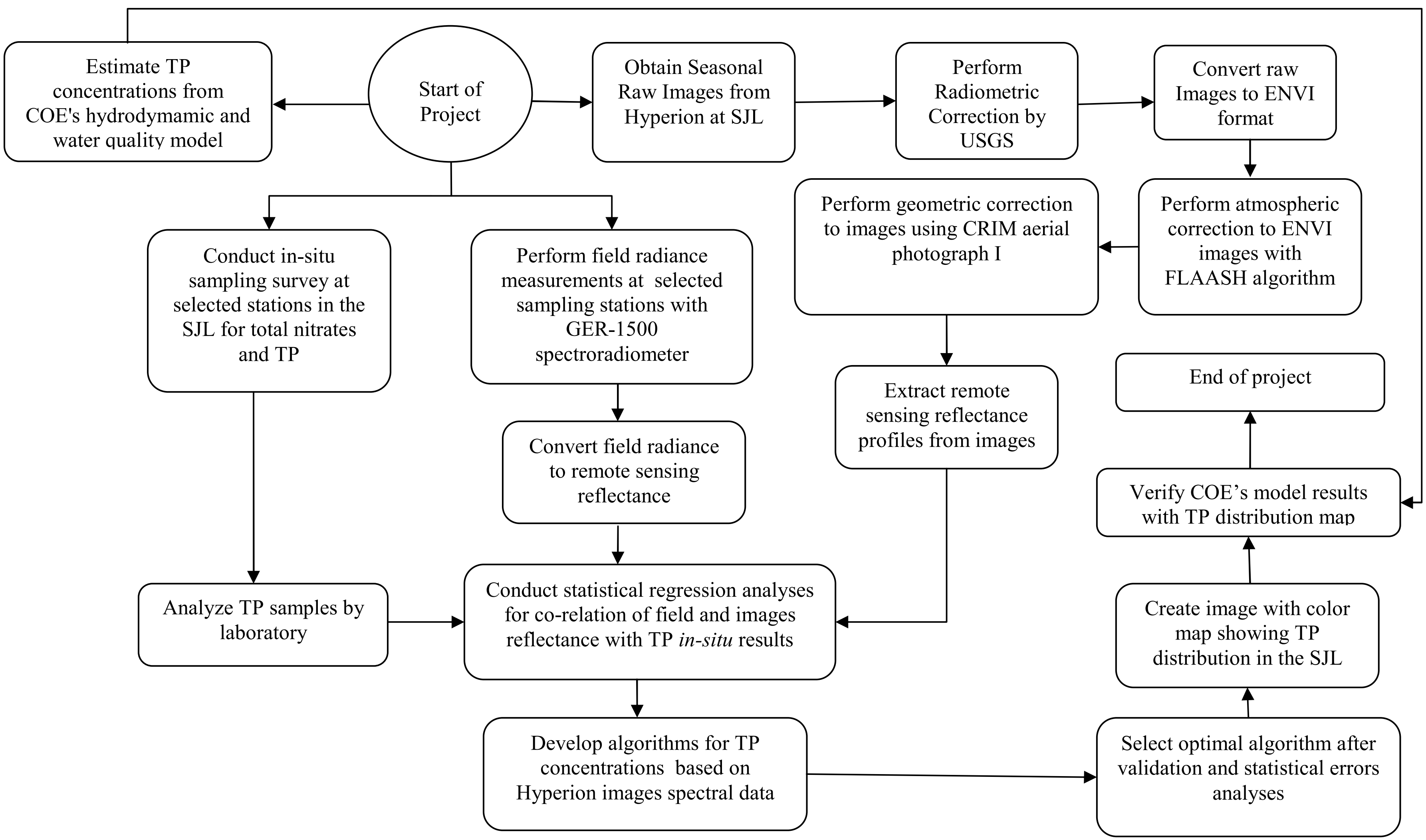

FIGURE 5-1: RESEARCH PROCEDURES DIAGRAM

VNIR and SWIR bands are nominally aligned to produce an HDF ENVI formatted header file. The image is provided by the USGS in sensor radiance values with units $W/m^2*sr*\mu m$ and data in 16-bit integers, and rescaled to produce the original radiance values.

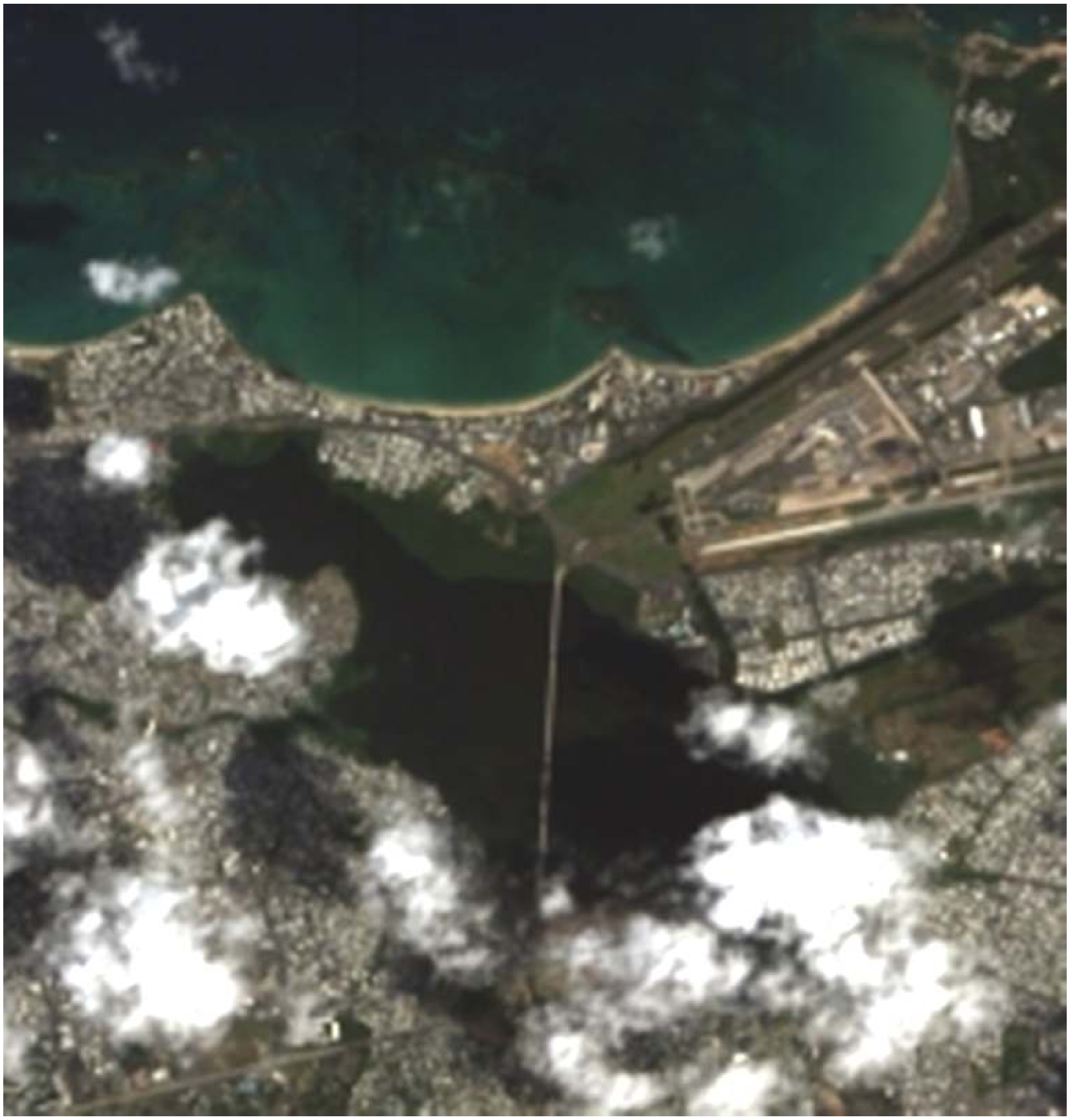

FIGURE 5-2: PRE-PROCESSED HYPERION IMAGE (FEBRUARY 24, 2006)

FIGURE 5-3: PRE-PROCESSED HYPERION IMAGE (MAY 12, 2006)

FIGURE 5-4: PRE-PROCESSED HYPERION IMAGE (AUGUST 14, 2006)

5.2 Conversion of Raw Images to ENVI Format

ENVI 4.2® is a state-of-the-art image processing software designed to provide comprehensive analysis of satellite and aircraft remote sensing data (Research Systems Inc., 2001). ENVI uses a generalized raster data format consisting of a simple flat binary file and a small associated ASCII (text) header file. The ENVI header file contains information used to read an image data file and is normally created the first time a data file is created by ENVI. The separate ENVI text header file provides information to ENVI about the dimensions of the image, the imbedded header if present, the data format, and other related information. The raster data is stored as a binary set of bytes in the Band Sequential Format (BSQ), Band Interleaved by Pixel (BIP), or Band Interleaved by Line (BIL) formats. The image conversion to ENVI format was completed with the use of the Basic Tools module where the Hyperion atmospheric radiance image files are input into ENVI where they converted into BIL format. Images stored in the BIL format have the first line of the first band followed by the first line of the second band, followed by the first line of the third band, interleaved up to the number of bands. Subsequent lines for each band are interleaved in a similar fashion. Spatial and spectral subsets are specified for the full scene and for the Hyperion 242 spectral bands, respectively. ENVI then creates an output file where the converted image data is stored. Atmospheric radiance Hyperion images were converted to the ENVI format. Figures 5-5, 5-6, and 5-7 show the pre-processed Hyperion images after conversion to the ENVI format.


FIGURE 5-5: ENVI PROCESSED HYPERION IMAGE (FEBRUARY 24, 2006)


FIGURE 5-6: ENVI PROCESSED HYPERION IMAGE (MAY 12, 2006)

FIGURE 5-7: ENVI PROCESSED HYPERION IMAGE (AUGUST 14, 2006)

5.3 Atmospheric Correction

Atmospheric corrections radiance to the raw images using the Atmospheric Correction Guide (Morillo, 2005) with the ENVI-Fast Line-of-Sight Atmospheric Analysis of Hyperspectral cubes (FLAASH) atmospheric correction module were performed. The Hyperion atmospherically corrected images are shown in Figures 5-8, 5-9, and 5-10.

The atmosphere scatters and absorbs some light when sunlight travels from the sun to the Earth's surface and then to the sensor. Atmospheric correction attempts to minimize these effects on image spectra. It is traditionally considered to be indispensable before quantitative image analysis or change detection using multispectral or hyperspectral data. Atmospheric correction algorithms have been developed to calculate concentrations of atmospheric gases directly from the detailed spectral information contained in hyperspectral imagery, without additional data about atmospheric conditions.

The FLAASH software was used to remove the spectral atmospheric transmission and scattered path radiance using MODTRAN4 (MODerate spectral resolution atmospheric TRANsmittance algorithm and computer model), which estimates atmospheric transmittance and radiance for frequencies from 0 to 50,000 cm^{-1} at moderate spectral resolution. Initially, the ACORN (Atmospheric CORrection Now) algorithm was used to perform the images atmospheric correction. ACORN software uses radiative transfer calculations and the measured, calibrated hyperspectral data to deduce a subset of the atmospheric effects present in the hyperspectral data set. These derived atmospheric

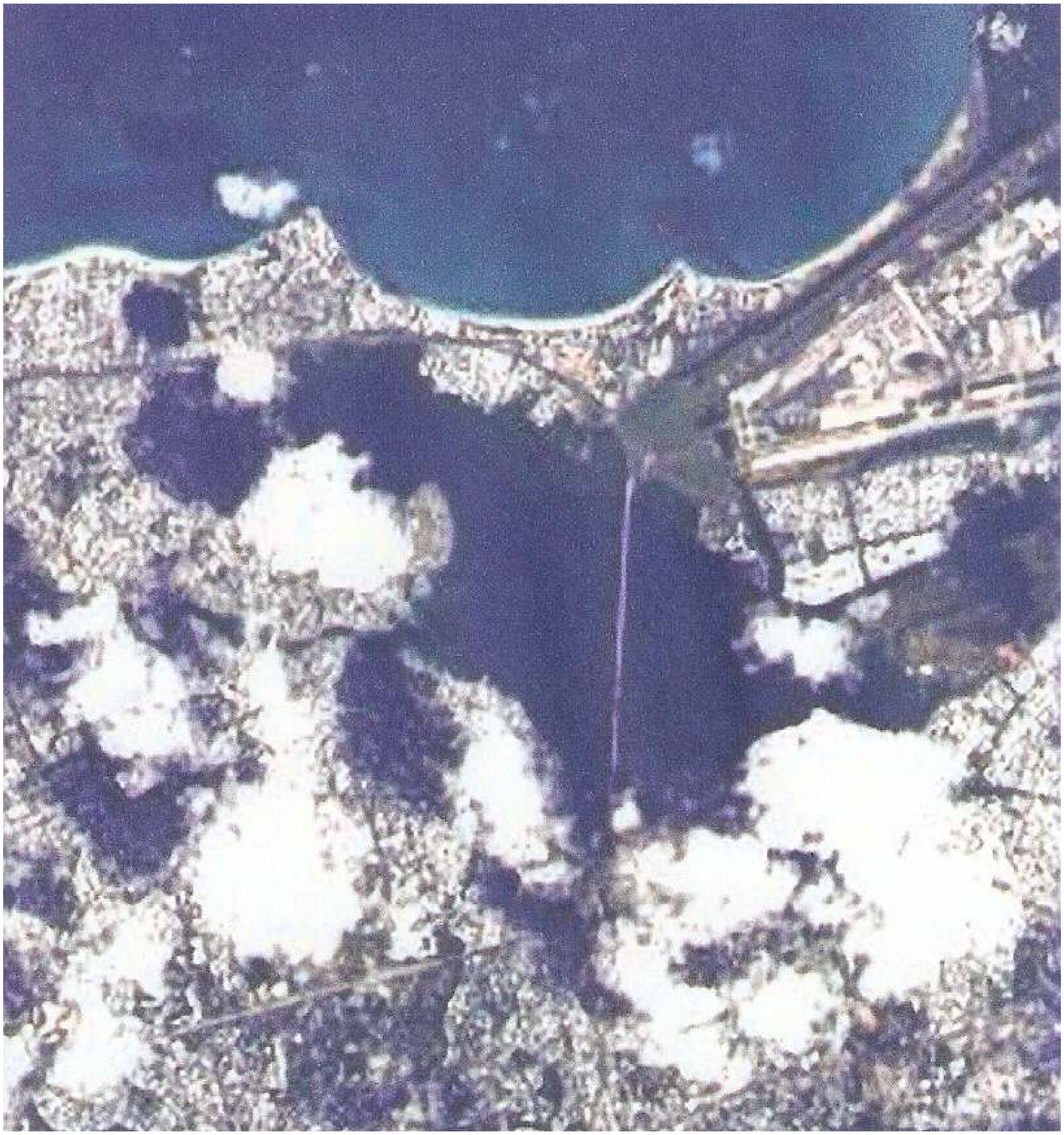

FIGURE 5-8: ATMOSPHERICALLY CORRECTED HYPERION IMAGE (FEBRUARY 24, 2006)

FIGURE 5-9: ATMOSPHERICALLY CORRECTED HYPERION IMAGE (MAY 12, 2006)


FIGURE 5-10: ATMOSPHERICALLY CORRECTED HYPERION IMAGE (AUGUST 14, 2006)

properties are used in conjunction with modeled atmospheric properties to correct for the atmosphere in the hyperspectral data set (Analytical Imaging and Geophysics, LLC). The FLAASH software was used after several trials of unsuccessful atmospheric correction attempts with the ACORN algorithm.

5.3.1 Atmospheric Corrections of Images with ENVI

The following steps were followed to complete the atmospheric corrections of the Hyperion images.

5.3.1.1 Model Input Parameters

The input parameters were defined considering the date of the satellite overpasses, location, climatic condtions, sensor type and altitude, pixel size, atmospheric model, aerosol model, and visibility.

The MODTRAN4 atmospheric correction algorithm requires that several values be provided in the FLAASH advanced settings dialogue (Morillo, 2005):

- Aerosol Scale Height- used for corrections to the adjacency scattering angle.
- CO_2 Mixing Ratio- applies for the normal CO_2 content in the atmosphere; for best results we used the default value of 390 parts per million (ppm).
- Reuse MODTRAN Calculations- used for expeditious image processing without modification of original conditions.
- MODTRAN Resolution- a 15/cm was used for better results.

- MODTRAN Multiscatter Model- an initial visibility of 40 kilometers was specified. FLAASH was run in the ISAACS multiple-scattering mode using the tropical atmospheric model and a maritime aerosol profile.

5.3.1.1.1 Radiance Scale Factors

Scale factors are applied to the atmospheric correction algorithm in order to convert the original radiance data into appropriate unit values of μW/ (cm^2*nm*sr). The scale factors are not the same for all bands. Bands from 1-70 are divided by 400, and from bands 71-242 are divided by 800. Other scale factors were rehearsed by trial and error in attempting to minimize the negative reflectance values produced by the Hyperion sensor within the lower (400-500 nm) and higher (800-1300 nm) spectral signal ranges for the February 24, 2006 image. Moreover, most of the spectral signal over the 800 nm is absorbed by the water. For this image, digital numbers from bands 1-70 were divided by 40, and from bands 71-242 were divided by 80.

Accounting for the Hyperion low signal-to-noise ratio, resulting in the sensor producing bad spectral data in certain channels, the Hyperion tools module was used to determine the best possible scale factors for the atmospheric correction. The Hyperion tools module was developed by ITT Corporation and is designed to facilitate the use of Hyperion data in ENVI. Its most basic functionality is to convert Level 1R HDF datasets into ENVI format files that contain wavelength, FWHM (Full-Width-Half Maximum), and bad band information. Also included are options specific to each input dataset format that further aid in using Hyperion data within ENVI.

The module generates a small text file in the specified output folder that contains scale factors necessary to correctly input Hyperion data into FLAASH. Each detector in Hyperion's pushbroom array has slightly different band center and FWHM values for each band. This option performs a linear interpolation across all detectors on a pixel by pixel, spectrum by spectrum, band by band basis to a common set of wavelengths. The module recommended the use of scale factors similar to the original values (400 and 800) used for all images, including the February 24, 2006. However, the use of such values still produced negative reflectance values at several stations. In correcting the problem, scale factors of 40 and 80 for bands 1-70 and 71-242, respectively, were used for the latter image. The use of such factors produced positive reflectance values for all of the evaluated stations. Scale factors of 400 and 800 were used for the May 12 and August 14, 2006 images.

5.4 Geometric Correction

A geometric correction was performed to all three Hyperion images using the ENVI 4.2® Map Registration module with GCPs provided to the Image to Image format.

Ground control points were established at five different sites covering the San José Lagoon area, as shown in Figure 5-11. Each control point was pre-selected from the Hyperion imagery with locations selected randomly as control coordinates for geo-reference purposes. Points were stored as latitude/longitude coordinates, as shown in Table 5-1, in separate files according to their time of collection.

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TABLE 5-1: GROUND CONTROL POINTS LOCATIONS

GROUND CONTROL POINT	**LATITUDE**	**LONGITUDE**
Suarez Channel	18°25’27.04”	-66°00’39.32”
Wetlands	18°26’6.71”	-66°01’42.27”
San Jose Urban Area	18°26’13.41”	-66°02’6.45”
Isla Verde Beach	18°26’48.24”	-66°00’58.92”
Teodoro Moscoso Bridge	18°26’2.81”	-66°01’19.92”

The latitude/longitude coordinates were converted by hand into decimal degrees in order to generate point coverage. The coverage was projected into State Plane (NAD 83) to coincide with the images’ projection. The image location and the real world State Plane coordinates were saved into a ground control point file in ENVI. A large-scale image of each ground control point was reproduced in a Centro de Recaudaciones de Ingresos Municipales (CRIM, 2007) aerial photograph (Figure 5-11) file for visual referencing.

FIGURE 5-11: SJL GROUND CONTROL POINTS (FEBRUARY 24, 2006)

The point coverage was then opened in an aerial photograph from the CRIM in ArcGIS format, and the same image was opened in ENVI 4.2®. UTM location was entered into State Plane North America datum of 1983. A spatial resolution of 30 X 30 meters in pixel size was specified, and GCPs were entered in the CRIM image based on the GPS selected field locations. A polynomial warped image file was created by ENVI 4.2® as part of the georeferencing process. Image resampling and registration was completed using ENVI's nearest neighbor method.

The image location and the real world State Plane coordinates were saved into a ground control point file in ENVI. Figure 5-12 shows the February 24, 2006 Hyperion warped image after geometric correction. The same procedure was followed for the May 12 and August 14, 2006 images.

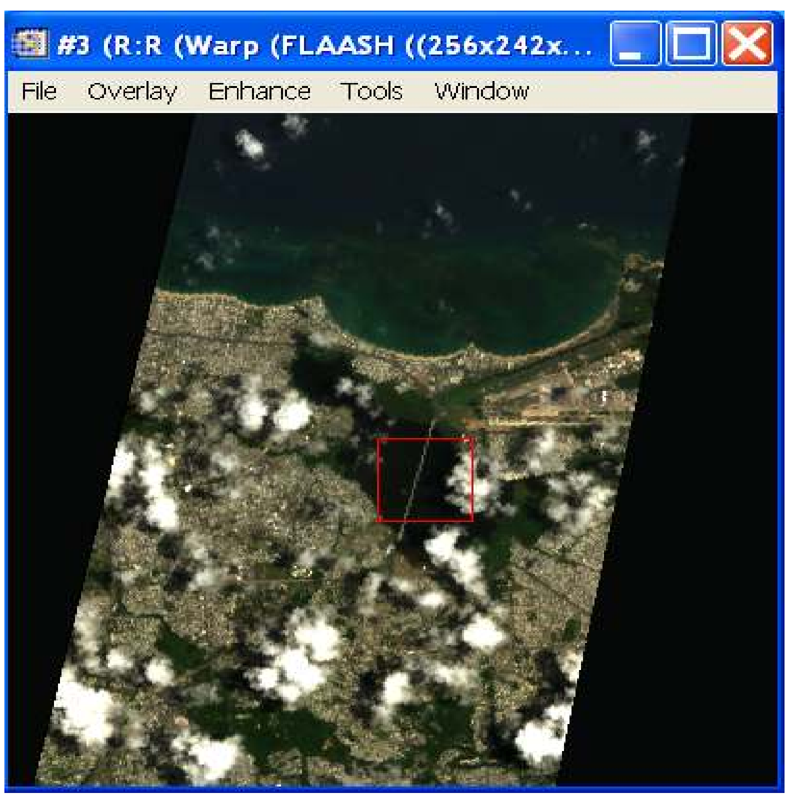

FIGURE 5-12: SJL GEOREFERENCED HYPERION IMAGE (FEBRUARY 24, 2006)

5.5 Extraction of Reflectance Spectral Profiles from Hyperion Images

Reflectance spectral profiles were extracted from the geometrically corrected warped Hyperion images with the use of the ENVI 4.2® Plot Parameter function, as shown in Figure 5-13 for Station no. 281 on February 24, 2006, as an example. The reflectance sample analysis was limited to the 400-800 nm wavelength spectral range obviating all remaining results considered as noise.

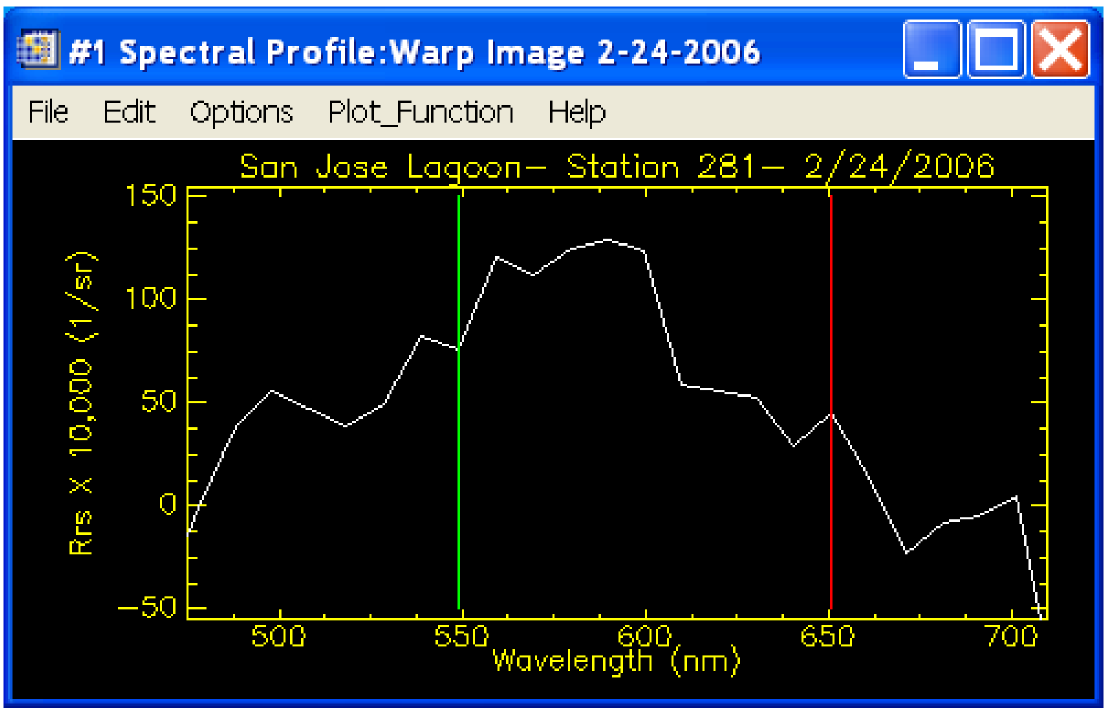

FIGURE 5-13: SPECTRAL PROFILE FOR STATION NO. 281 (FEBRUARY 24. 2006)

Remote sensing reflectance values are magnified by the FLAASH atmospheric correction algorithm with an output reflectance factor of 10,000. Thus, the remote sensing reflectance quantities shown in the figure must be divided by the same magnifier to obtain the correct values. ASCII files were then created from the Hyperion images containing all reflectance values per wavelength for each one of the stations monitored during the sampling survey. The data in the ASCII files were then copied into EXCEL® 2003 spreadsheets, later used to complete the statistical regression analyses.

5.6 Field Sampling

5.6.1 Research Sampling Survey (2006)

An *in situ* sampling survey was conducted at the SJL to obtain and analyze total phosphorus and nitrates grab samples in accordance with EPA approved quality control/quality assurance procedures. A total of forty (40) sampling stations were selected for nitrates and TP analyses, as shown in Figure 5-14. These were arranged at approximately 3-5 meters apart with samples obtained at the water surface. Total nitrates were mostly below detection limits, a condition which may create an imbalance in aquatic species production rates in the SJL due to the absence of such nutrient.

FIGURE 5-14: *IN SITU* WATER QUALITY SAMPLING STATIONS

A portable Geographical Positioning System (GPS) receptor with less than ± 1-foot of horizontal and 1-meter of vertical accuracies was used to locate the sampling stations. All locations were based on Universal Traverse Mercator (UTM) coordinates. Field samples were limited to the northern, southern, and eastern section of the lagoon. No samples were obtained from the western section due to its very shallow bottom conditions, which would affect the reflectance measurements from the sensor. Table 5-2 details the SJL used sampling locations during the field survey.

TABLE 5-2: SAMPLING POINTS LOCATIONS

Name	Lat North	Lon West	Name	Lat North	Lon West	Name	Lat North	Lon West
266	18 °25' 24.1"	66° 00' 54.0"	281	18° 25' 35.4"	66° 01' 22.4"	296	18° 25' 26.7"	66° 01' 28.9"
267	18° 25' 15.2"	66° 00' 48.8"	282	18° 25' 32.4"	66° 01' 23.4"	297	18° 25' 29.7"	66° 01' 28.2"
268	18° 25' 09.3"	66° 00' 52.3"	283	18° 25' 29.7"	66° 01' 24.0"	298	18° 25' 32.8"	66° 01' 27.3"
269	18° 25' 11.2"	66° 00' 57.9"	284	18° 25' 27.3"	66° 01' 24.2"	299	18° 25' 39.7"	66° 01' 25.1"
270	18° 25' 12.7"	66° 01' 02.6"	285	18° 25' 24.7"	66° 01' 24.8"	300	18° 25' 42.0"	66° 01' 24.5"
271	18° 25' 16.9"	66° 01' 06.6"	286	18° 25' 21.8"	66° 01' 25.4"	301	18° 25' 44.6"	66° 01' 24.1"
272	18° 25' 24.8"	66° 01' 07.7"	287	18° 25' 18.7"	66° 01' 25.7"	302	18° 25' 47.7"	66° 01' 23.4"
273	18° 25' 25.1"	66° 01' 07.6	288	18° 25' 16.1"	66° 01' 25.2"	303	18° 25' 49.7"	66° 01' 22.8"
274	18° 25' 31.7"	66° 01' 08.3"	289	18° 25' 09.2"	66° 01' 22.3"	304	18° 25' 51.3"	66° 01' 22.2"
275	18° 25' 36.5"	66° 01' 10.6"	290	18° 25' 04.5"	66° 01' 20.5"	305	18° 25' 53.2"	66° 01' 21.2"
276	18° 25' 40.3"	66° 01' 12.9"	291	18° 25' 09.0"	66° 01' 26.6"			
277	18° 25' 48.2"	66° 01' 15.7"	292	18° 25' 12.4"	66° 01' 28.1"			
278	18° 25' 45.7"	66° 01' 18.1"	293	18° 25' 17.0"	66° 01' 29.1"			
279	18° 25' 42.1"	66° 01' 19.8"	294	18° 25' 20.7"	66° 01' 29.5"			
280	18° 25' 38.6"	66° 01' 21.2"	295	18° 25' 24.3"	66° 01' 29.4"			

Results for various stations were considered as less reliable due to various reasons: repeated station numbers in bottles, incorrect station results, inexact location due to boat movement and prevailing strong winds, and some bottles without preservatives. Of these, thirty-six (36) were actually used for the research. The remaining four (4) stations could not be used at all and were discarded from further analysis. The stations were selected to uniformly cover most of the deeper section of the lagoon, and closer to the Teodoro Moscoso bridge where the consistent shallower portion of the SJL would provide representative nutrients results for the lagoon's western locations. Field samples analyses were complete, and results were provided by a private environmental laboratory in accordance with 40 CFR Part 136 included in the Manual of Methods for Chemical Analysis for Water and Wastes (USEPA, 1974). Nitrate as nitrogen samples were analyzed following EPA Method 353.2 (Nitrate-Nitrite Nitrogen by Colorimetry). Total Phosphorus samples were analyzed following EPA Method 365.3 (Ascorbic Acid). Quality Control/Quality Assurance documentation (chain-of-custody) for all samples was also provided by the private laboratory. Appendix B contains the nitrates and total phosphorus results for each sampling event, and a chain-of-custody completed sample form.

5.6.2 USCOE Sampling Survey (1995)

Water samples were obtained by the COE at all open-water stations (Kennedy *et al.*, 1996), as shown in Figure 5-15, for the Los Corozos Lagoon marked as SJ-1, Martin Peña Channel inlet as SJ-2, and for the San José Lagoon marked as SJ-3, 4 and 5. Table 5-3 describes the location of each open-water sampling station used by the COE. They were obtained at mid-depth (less than 3-meters), and near surface (0.5 m). Quality Control/Quality Assurance (QA/QC) procedures were followed in the handling of the samples. The water samples were initially retained in rinsed, 1-liter polyethylene (PPE) bottles, placed on ice, and stored in the dark. A fraction of each sample was filtered (0.45-μm membrane) and stored in PPE and amber glass bottles within 6 hours of collection. The remaining unfiltered fraction was stored in PPE and amber glass bottles. Samples for selected analyses were acidified with 1:1 H_2SO_4 to pH < 2. All samples were stored in coolers, refrigerated with ice packs, and shipped via overnight delivery to the analytical laboratories.

FIGURE 5-15: USCOE OPEN-WATER SAMPLING STATIONS (SAN JUAN BAY AND ESTUARY STUDY, 1996)

TABLE 5-3: OPEN-WATER SJL SAMPLING STATIONS

SAMPLING STATION	**LOCATION**	
	LATITUDE	**LONGITUDE**
SJ-3	N18°25’4.2”	W66°1’34.8”
SJ-4	N18°25’36.6”	W66°1’28.2”
SJ-5	N18°25’25.2”	W66°0’42.6”

Sample numbers SJ-4 and 5 are within our research sampling perimeter.

5.7 Field Radiance

Field radiance values were obtained at each sampling station per sampling event using the GER-1500 spectroradiometer. Field optical water properties were concurrently obtained with the GER 1500 spectroradiometer (Figure 5-16), which produces spectral data at 5-nanometers (nm) bandwidths. Field radiance values were obtained at each sampling stations per sampling event. Remote sensing reflectance was then calculated from average radiance values obtained from the spectrometer at each sampling station. A total of nine (9) radiance measurements were obtained from each station. Appendix C contains all field radiance values obtained with the spectroradiometer.

FIGURE 5-16: GER 1500 SPECTRO-RADIOMETER

5.8 Conversion of Field Radiance to Remote Sensing Reflectance.

Total water radiance, sky radiance, and downwelling irradiance values were used to calculate the remote sensing reflectance. Both water and sky radiances were measured at 45°. Three (3) replicates of each measurement were taken per sample location. These values were then correlated with the Hyperion reflectance values obtained through a separate procedure, as will be mentioned in section 6-3. Appendix C contains all field radiance and remote sensing field reflectance measurements obtained from each sampling station.

Remote sensing reflectance (R_{RS}) field values were obtained through:

$$R_{RS} = \frac{L_o - fL_S}{E_d} \quad (\mathrm{sr}^{-1}) \quad \text{(Mobley, 1994).} \qquad (5\text{-}1)$$

R_{RS} is defined in terms of the direction of the water leaving radiance relative to the surface. The total water leaving radiance (L_o) is a function of the water leaving direction and the wavelength. f is the Fresnel number with a value of 0.028 for a 45° measurement inclination. The downwelling irradiance (E_d) is evaluated just above the surface for each wavelength

5.9 Statistical Data Regressions

Statistical correlations were developed for the Hyperion-derived images remote sensing reflectance results versus total phosphorus concentrations for several sampling stations. The regression analyses were conducted with the Pearson regression test using the statistical least square method by best fitting the data obtained from both the images and the field. If we have a series of n measurements of x and y written as x_i and y_i where i = 1, 2, ..., n, then the Pearson product-moment correlation coefficient can be used to estimate the correlation of x and y:

$$r_{xy} = \frac{n\sum x_i y_i - (\sum x_i)(\sum y_i)}{\sqrt{n\sum x_i^{\ 2} - (\sum x_i)^2}\sqrt{n\sum y_i^{\ 2} - (\sum y_i)^2}} \qquad (5\text{-}2)$$

The square of the sample correlation coefficient, which is also known as the coefficient of determination (r^2_{xy}), is the fraction of the variance in y_i that is accounted for by a linear fit of x_i to y_i. This is written as:

$$r^2_{xy} = 1 - \frac{S^2_{y|x}}{S^2_y} \tag{5-3}$$

where $S^2_{y|x}$ is the square of the error of a linear regression of x_i on y_i by the equation $y = a + bx$:

$$S^2_{y|x} = \frac{1}{n-1}\sum_{i=1}^{n}(y_i - a - bx_i)^2 \tag{5-4}$$

and S_y^2 is the variance of y:

$$S^2_y = \frac{1}{n-1}\sum_{i=1}^{n}(y_i - \bar{y})^2 \tag{5-5}$$

Since the sample correlation coefficient is symmetric in x_i and y_i the same value will result for a fit of y_i to x_i.

$$r^2_{xy} = 1 - \frac{S^2_{x|y}}{S^2_x} \tag{5-6}$$

For this study, the values of x_i and y_i corresponded to the results of the remote sensing reflectance and total phosphorus concentration for the sampled stations, respectively. Different band combinations were trialed aimed at obtaining the highest correlation of remote sensing reflectance and total phosphorus. Individual, ratios, and log band ratios were developed per wavelength, per sampling station. Logarithmic transformation is useful in cases where it is necessary to stress the difference between scores in a manner that is proportional to their ratio rather than in terms of their absolute value (Shafique *et al*, 2001). Each one of these was completed for the February, May, and August, 2006 surveys. Appendix D contains all statistical correlations completed, as stated above. An algorithm was developed based on the highest correlation obtained from the statistical analyses.

Uncertainty analysis was conducted to the runs with the highest correlation coefficients and lowest statistical errors, with results detailed in Section 6-2. The safety margin (SM) method was used to determine the reliability of the total phosphorus concentrations results obtained after the corresponding algorithm application and compared to the *in situ* samples from the field survey. The SM method is based on the difference between two random variables (x_i and y_i), where the system certainty is

$$\alpha = P(x_i - y_i \geq 0) = P(SM \geq 0) \tag{5–7}$$

If x_i and y_i are random variables, then SM will be normally distributed with a mean and a variance. Then,

$$\mu_{SM} = \mu_{x_i} - \mu_{y_i} \tag{5-8}$$

and

$$\sigma_{SM}^2 = \sigma_{x_i}^2 + \sigma_{y_i}^2 - 2Cov(x_i, y_i) \tag{5-9}$$

where:

μ = mean value of x_i and y_i

μ_{sm} = mean value safety margin

σ_{SM} = standard deviation safety margin

σ_{SM}^2 = variance of x_i and y_i safety margin

Cov- covariance of random variables.

Mean error (*ME*), absolute mean error (*AME*), root mean square (*RMS*) error, and relative error (RE) were estimated for each one for the scatter plots. The *ME* is a summary of the model tendency to overestimate or underestimate the observed data. ME can be zero even though large discrepancies exist in individual model-data comparisons. Mean error is computed as follows:

$$ME = \frac{\sum(O-P)}{n} \tag{5-10}$$

where:

ME = mean error

O = observation

P = model prediction

n = number of observations

The AME is a measure of the average discrepancy between observations and model results. No differentiation is made between overestimation and underestimation. Absolute mean error is computed as follows:

$$AME = \frac{\sum|O-P|}{n} \tag{5-11}$$

The RMS error is an indication of the average discrepancy between observations and model results.

$$RMS = \sqrt{\frac{\sum|O-P|^2}{n}} \tag{5-12}$$

The RE is the absolute mean error normalized by the magnitude of the observations. It is expressed as a percent and is computed as follows:

$$RE = \frac{\sum|O-P|}{n\sum O} \text{ X } 100 \qquad (5\text{-}13)$$

5.10 Application of Algorithm and Development of Color Water Quality Map

The selected algorithm was applied to the Hyperion image to produce a total phosphorus water quality map. The algorithm was developed from the remote sensing reflectance versus total phosphorus statistical regression based on the highest correlation, certainty analyses, and statistical errors evaluation criteria. The spatial distribution of water quality information is produced using algorithms from satellite-based observations and also verified by *in situ* measurements. These empirical methods provide site-specific predictions of water quality with reasonable accuracy (Chen *et al*, 2007). Color water quality maps were created showing the total phosphorus distribution in the San José Lagoon after application of the algorithm to all of the Hyperion images. Section 6-4 includes all total phosphorus distribution color maps created from the Hyperion spectral data.

5.11 Water Quality Model Verification

The Unites States Army Corp of Engineers (COE) CH3D-WES hydrodynamic and CE-QUAL-ICM (ICM) water quality models results were used as a comparison to verify the total phosphorus concentrations obtained from the Hyperion image after application of the empirical algorithm. All hydrodynamic data used by the ICM model was provided by the CH3D-WES, as obtained from the 1995 study conducted by the COE (Bunch *et al*, 2000)

The inputs to the CH3D-WES model consisted on field data obtained during the 1995 study. Water-surface elevations, salinity, and water-velocity data were collected at several locations. At the start of a model run, the values of ζ, u, v, w, U, and V are all set to zero. Values of the salinity and temperature were obtained from input files. These initial fields were generated from known data at a limited number of locations. A planform fitted numerical grid was developed containing 2690 cells with a maximum of 30 vertical layers. Each layer is 3 ft (0.91 m) thick except for the top layer which varies with the tide.

An Acoustic Doppler Current Profiler (ADCP) was used by the COE to collect data over several ranges in an attempt to define the water flux through the connecting channels of the system. Model adjustment was centered on the reproduction of observed tides throughout the system, reproducing the extreme stratification in salinity that often exists in the channels, and reproducing the net flux through the Martín Peña and Suárez channels.

All modeled parameters in the water column and sediments required initial conditions as part of the ICM calibration process. At the end of the first calibration run, the concentrations of all constituents in all water column and sediment cells were stored in a binary file. This file was then used as the initial conditions for a second calibration run. At the completion of the second calibration run, concentrations for all cells were again written to a binary file which was used as the initial conditions for the third calibration run. This process is repeated in subsequent calibration runs until a quasi steady-state condition (in terms of initial conditions) is reached in both the water column and sediment cells.

CH3D-WES was adjusted by reproducing reaching tides, salinity, exchange between lagoons, and variation of model coefficients. All boundary conditions for the model adjustment were developed from field data conditions during June-August, 1995. Water-surface elevations, salinity and water-velocity were obtained at different stations throughout the system.

Tides were reproduced with data obtained from a three-day period in July 1995 considering the significant dimensions reduction in the Martín Peña and Suárez channels. The model also showed that the reduction in tidal flushing in the SJL has resulted in a lower water quality within the system.

The model was initiated with a constant salinity over the grid and run for the month of June, 1995. The computed salinity field was then saved and used as the initial salinity field in all subsequent simulations for the entire three months.

The exchange between the San Juan Bay (through the Martín Peña) and the San José Lagoon, and from the Torrecillas lagoon to the San José Lagoon was needed since such activities are a major component for the water quality estimations performed by the model and the feasibility of improving flushing conditions. Total flux volumes were determined for both channels. These fluxes represent the sum of the net freshwater inflows into the various lagoons minus the volume of the water evaporated.

The model coefficients for variations are the drag, horizontal diffusion, and the minimum and maximum values of the vertical diffusion for momentum and salinity. The value of the drag coefficients was set at 0.002 throughout the system. A typical horizontal diffusion coefficient of 10 m^2/s was selected for the horizontal directions. The minimum values specified for the vertical viscosity and vertical diffusivity was 5 and 0.001 cm^2/s, respectively, whereas, the maximum value for both was set to 500 cm^2/s.

The model was updated with climate data following the same procedures used by the COE in their 1995 study (Bunch *et al*, 2000). Model calibration was assessed with plots of model output and observed data. Scatter plots of model output and observed data provide an indication of overall model performance. Calibration period-average longitudinal transect plots were used during calibration as they are indicative of model performance at a variety of locations during the simulation.

The scatter plots contain comparable observations from the February 24, 2006 Hyperion imagery (with the application of the empirical algorithm), the *in situ* samples obtained during the same day, and the results from the ICM model, all for total phosphorus as the water quality parameter monitored during the current study.

Longitudinal transect plots were completed by the COE as part of the ICM model calibration. The transects were located at the mouth of the San Juan Bay, passing through the Caño Martín Peña, San José Lagoon, Suárez channel, and ending in the mouth of the Torrecillas lagoon. The route of this transect was through five of the major features of the San Juan Bay Estuary system. Two transects were adopted for each constituent. One transect is for cells in the surface layer while the other is for cells in the bottom layer. Since the present bathymetric conditions in the San José Lagoon have not significantly changed after the 1995 results we have also adopted the COE's resulting transect comparisons for purposes of this research.

6. RESULTS AND DISCUSSION

6.1 Total Phosphorus Concentrations from *In Situ* Measurements

6.1.1 Research Sampling Survey (2006)

In situ total phosphorus samples exhibited great seasonal variability at most of the stations. The largest concentrations were recorded during the February 24, 2006 survey where the total phosphorus concentrations showed a significant increase as compared to the other sampling events, while much smaller concentrations resulted during the months of May and August. Table 6-1 shows the *in situ* total phosphorus sample results (in milligrams per liter as P) for each surveyed station. Figure 6-1 shows the arithmetic mean of the total phosphorus concentrations during the surveyed time period.

TABLE 6-1: TP *IN SITU* SAMPLE RESULTS (mg/l as P) (36 STATIONS)

STATION SAMPLED	AUGUST 8, 2005	NOVEMBER 7 2005	FEBRUARY 24 2006	MAY 12, 2006	AUGUST 14 2006
266	0.109	0.088	0.205	0.062	BDL
268	0.122	0.062	1.02	0.052	0.021
269	0.232	0.064	0.386	0.067	0.037
270	0.267	0.072	0.199	0.088	0.010
271	0.332	0.085	0.538	0.071	0.057
272	0.254	0.084	0.807	0.074	BDL
273	0.000	0.000	0.538	0.597	0.01
274	0.763	0.093	0.253	0.219	0.031
275	0.139	0.079	0.155	1.05	BDL
276	0.205	0.060	0.278	0.056	BDL
277	0.177	0.119	0.197	0.049	0.024
278	0.148	0.062	0.200	1.11	0.015
279	0.184	0.078	0.129	1.11	0.013
280	0.148	0.070	0.187	0.080	0.033
281	0.195	0.070	0.214	0.126	0.029
282	0.167	0.072	0.240	0.127	BDL
283	0.167	0.069	0.197	0.162	0.215
284	0.177	0.081	0.195	0.064	0.034
286	0.187	0.071	0.273	0.049	BDL
287	0.145	0.095	0.138	0.167	0.057
288	0.145	0.062	0.386	0.123	0.02
289	0.155	0.094	0.336	0.345	0.033
290	0.145	0.080	0.353	1.050	0.038
291	0.208	0.070	0.200	0.064	0.000
292	0.132	0.070	0.126	0.460	0.03
293	0.126	0.072	0.030	0.043	0.146
294	0.179	0.090	0.633	0.141	BDL

STATION SAMPLED	AUGUST 8, 2005	NOVEMBER 7 2005	FEBRUARY 24 2006	MAY 12, 2006	AUGUST 14 2006
295	0.763	0.083	0.180	0.141	0.031
296	0.208	0.072	0.214	0.338	0.131
297	0.131	0.079	0.181	0.248	0.000
298	0.993	0.072	0.906	0.471	BDL
299	0.178	0.100	0.152	0.248	0.036
300	0.511	0.071	0.848	0.098	BDL
301	0.112	0.080	0.577	0.447	BDL
302	0.263	0.010	0.201	0.260	BDL
304	0.163	0.066	0.629	0.057	BDL

BDL- Below Detection Limit- taken as 0 value for analysis purposes

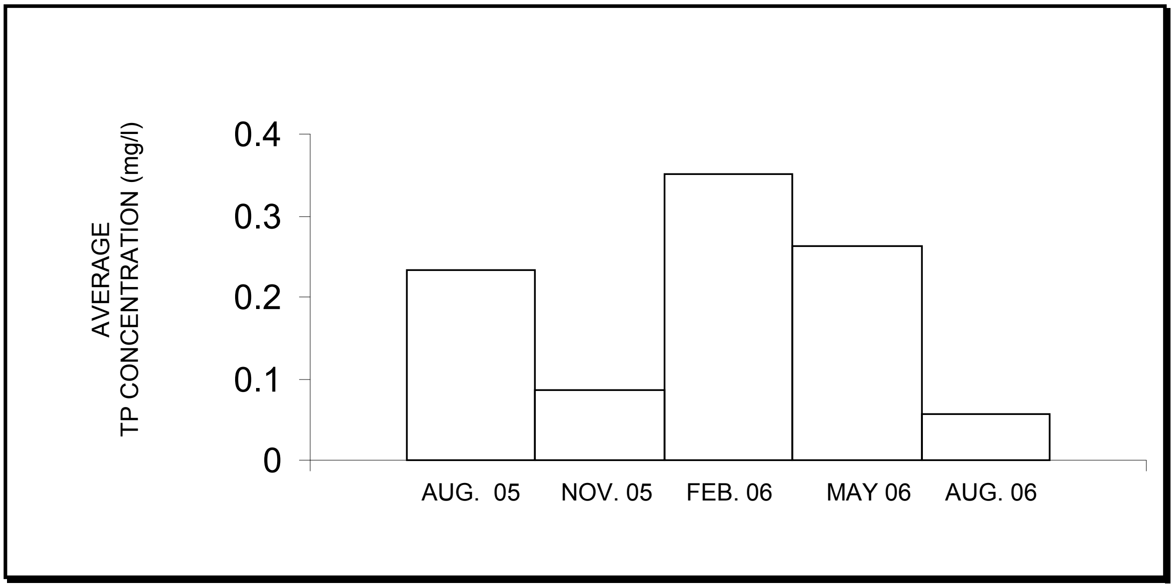

FIGURE 6-1: AVERAGE *IN SITU* TP CONCENTRATIONS- RESEARCH SAMPLING SURVEY

6.1.2 USCOE Study Sampling Survey (1995) and ICM Model Applicability

All samples at the San José Lagoon were obtained on June, July, and August, 1995 at stations SJ-3, 4 and 5. Figure 6-2 shows the arithmetic mean of the total phosphorus concentration from the COE 1995 survey.

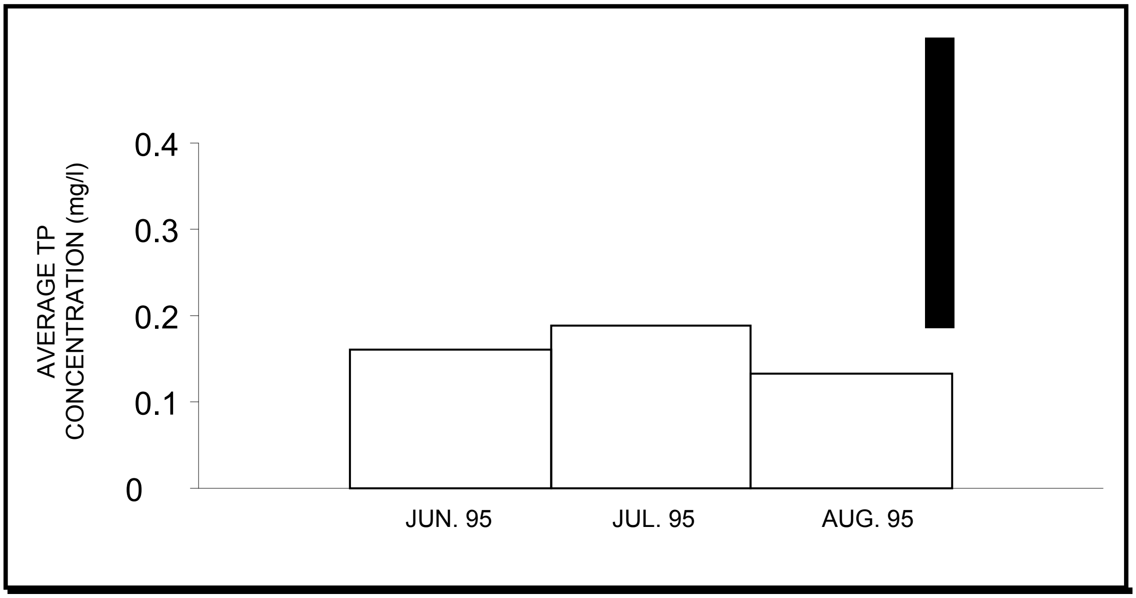

FIGURE 6-2: AVERAGE *IN SITU* TP CONCENTRATIONS- USCOE SAMPLING SURVEY

Figure 6-3 shows the ICM model results for TP based on the *1a* versus *1b* water quality management scenarios.

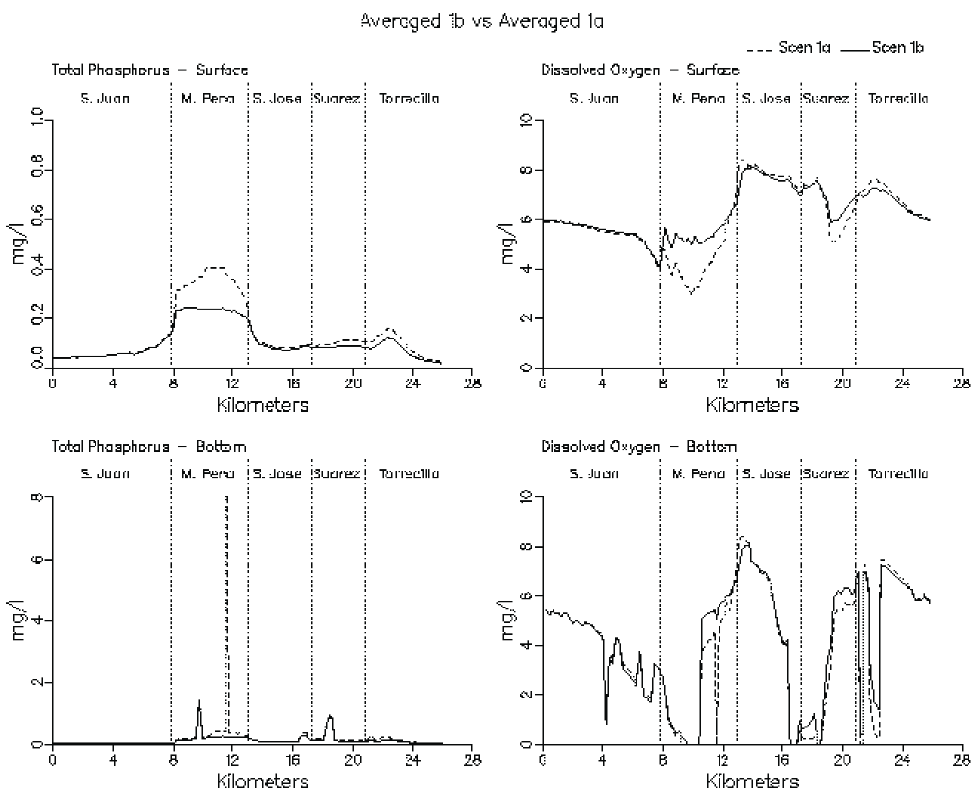

FIGURE 6-3: TP CONCENTRATIONS FROM ICM MODEL (Bunch *et al*, 2000)

The 2000 COE's calibrated hydrodynamic model shows TP results consistent with those from February 24, May 12, and August 14, 2006 Hyperion images, after calculated with the algorithm. This is evidenced by the similar results shown by the model and Hyperion where both predict seasonally uniform total phosphorus concentrations less than 0.1 mg/l, and significantly higher total phosphorus concentrations (over 0.5 mg/l) produced within the dredged pits locations. Based on these results it can be inferred that:

- No significant changes have occurred to Caño Martín Pena or Suárez Channel in the intervening years. This means that the flow conditions in/out of the SJL are essentially the same in 2006 as 1995.
- No significant changes have occurred in watershed directly contributing to the SJL. The infrastructure is essentially unchanged in the watershed so the volume of and loads in the runoff are comparable.
- Hydrodynamic and water quality information had been already observed for 1995. It is unlikely to find a water quality data set in other years as extensive as compared to 1995. Any uncertainty induced using an incomplete data set for another year is as large, or larger than the uncertainty induced by comparing 2006 and 1995.
- No significant changes have occurred to the bathymetry of the lagoon, (i.e., no significant dredging or filling), with the exception of the Teodoro Moscoso Bridge construction. However, the bridge was inaugurated on February 23, 1994, (http://graduados.uprrp.edu/planificacion/facultad/elias-gutierrez/ERGPUENTE.pdf)

sixteen months before the USCOE conducted the 1995 study. This means that the hydraulic residence time is "unchanged" and the sediment/water column processes associated with the existing dredge holes are unchanged.

6.2 Field Remote Sensing Reflectances

All field remote sensing results were estimated using equation 5-1 with the total sky and water radiances, and downwelling irradiances obtained on February 24, May 12, and August 14, 2006 from the San José Lagoon with the GER-1500 spectroradiometer. Figures 6-4, 6-5, and 6-6 show the field remote sensing reflectance curves for each sampling occasion. The curves were developed by averaging the calculated reflectances per wavelength for each sampling station with estimated standard deviations.

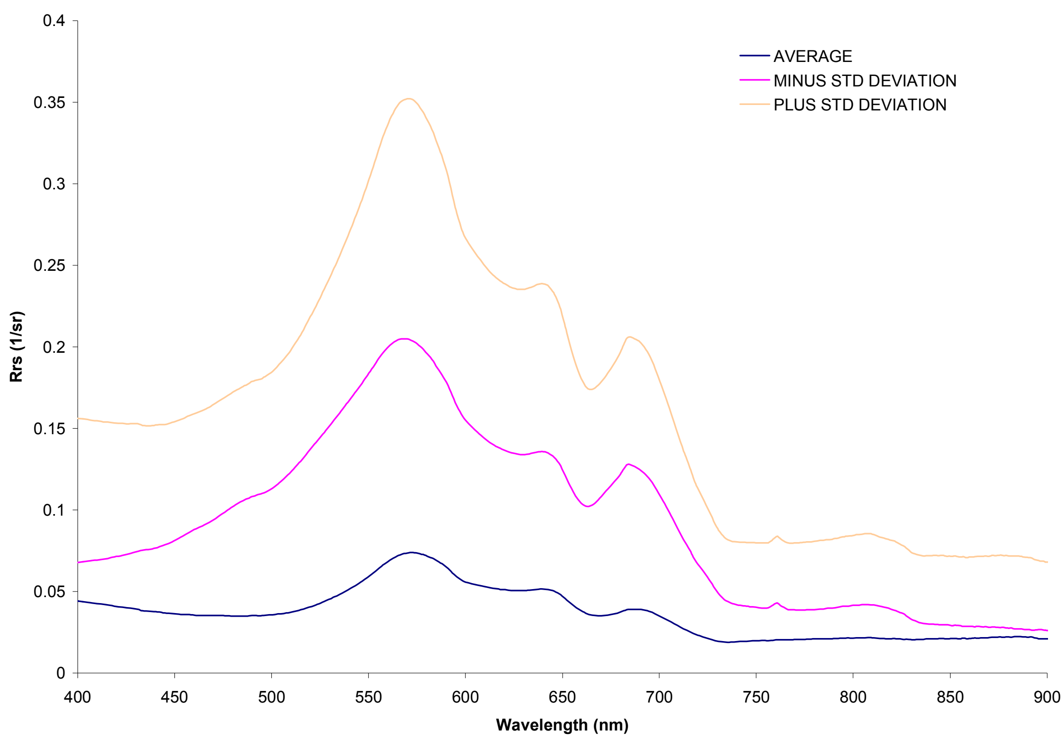

FIGURE 6-4: FIELD REMOTE SENSING REFLECTANCE- FEBRUARY 24, 2006

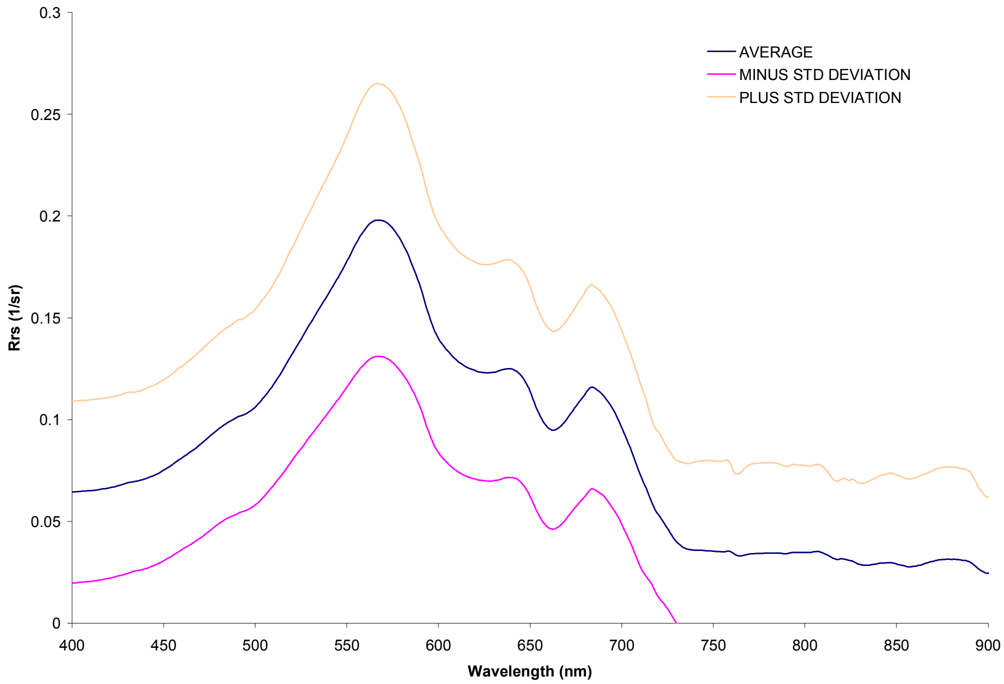

FIGURE 6-5: FIELD REMOTE SENSING REFLECTANCE- MAY 12, 2006

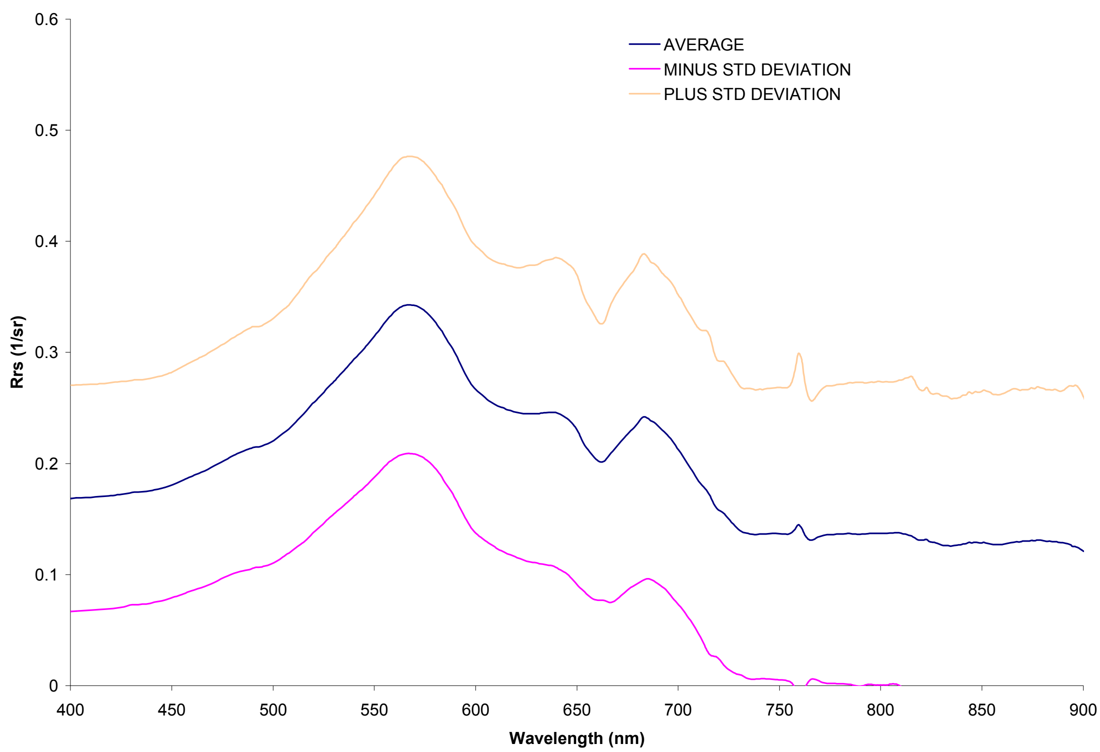

FIGURE 6-6: FIELD REMOTE SENSING REFLECTANCE- AUGUST 14, 2006

Figure 6-3 demonstrates high variability and dispersion in the remote sensing reflectance results obtained from the February 24, 2006 sampling as compared to Figures 6-4 and 6-5, which shows the reflectance results for May 12 and August 14, 2006, respectively. Reflectance peaks at the 550-600 nm range within the green region of the visible spectrum evidences the algae proliferation within the lagoon. Algae possess chlorophyll, the green pigment essential for photosynthesis, and often contain additional pigments that mask the green color. The presence of higher algae contents in the San José Lagoon is indicative of excessive chlorophyll-a concentration, a condition created by increased levels of nutrients within the water system. While the algae photosynthetic process produces dissolved oxygen during the day, at night the algae respiration consumes excessive oxygen which depletes its availability during the day. Such conditions may create life threatening conditions for aquatic organisms within the ecosystem.

6.3 Correlations and validations between TP field sampling results and remote sensing reflectance data

Statistical correlations were estimated for individual reflectance, ratios and log ratios. The spectral bands with wavelengths at 428, 457, 488, 529, 569, and 579 in the visible region of the spectrum, and 770, 772, and 778, in the near infra-red region seem to be leading the spectral indices evaluated. The ratio indices using 770 and 778 provide abiding total phosphorus information from the field spectroradiometer, while the 428, 457, 488, and 529 are more accurate about this water quality parameter from the Hyperion images. Correlation analyses were not completed for total nitrates due to their concentrations resulting in below detection limits for all sampling surveys completed. A 35% error typical of remote sensing measurements in water was applied to the validation analyses. Many of the correlations were not includedAn algorithm was developed for this study for the measurement of TP, using the 467 nm and 529 nm relationship, obtained from the combined Hyperion February 24, 2006 and August 14, 2006 combined images. Many of the estimated correlations were not completed in the analysis due to their coefficients of regression exceptionally lower resulting values.

Thirty-six (36) out of the forty (40) sampling stations originally selected were used for this research. The results obtained from the remaining four (4) stations were discarded for different reasons: incorrect station number, partial results delivered, and quality control/quality assurance errors. Correlation analyses were not completed for total nitrates due to their concentrations resulting in below detection limits for all sampling surveys completed. A 35% error typical of remote sensing measurements in water was applied to the validation analyses. An algorithm was developed for this study for the measurement of TP, using the 467 nm and 529 nm relationship, obtained from the combined Hyperion February 24, 2006 and August 14, 2006 images.

$$\text{TP (mg/l)} = 0.3232\left(\frac{R467}{R529}\right)^2 - 0.3801\left(\frac{R467}{R529}\right) + 0.1128 \qquad (6\text{-}1)$$

The phosphorus concentrations were then estimated with the derived algorithm and the results were validated with the May 12, 2006 TP *in situ* sample results. The algorithm is developed from the polynomial relationship of the corresponding reflectance ratio obtained from the 467 and 529-nanometers bands. Such algorithm produced a coefficient of determination of 0.49. The phosphorus concentrations were then estimated with the derived algorithm and the results were validated with the May 12, 2006 TP *in situ* sample results.

Table 6-2 identifies the figure numbers for regression plots for the different statistical correlations, algorithm validation for each completed regression, and scatter plots comparing predicted and observed total phosphorus concentrations, for each band combinations evaluated.

Figure 6-7 shows the linear correlation results for TP concentrations using the GER-1500 spectroradiometer. A robust coefficient of determination (r^2) of 0.654 obtained from the remote sensing reflectance ratio of bands at 770 and 778-nanometers demonstrates reliability on the field remote sensing reflectance at near-infrared region of the spectrum. This is attributed to the increased spectral resolution provided by the instrument which retrieves radiance results at 5-nanometers bandwidth wavelengths, as compared to the Hyperion averaged 10-nanometers. Different from the Hyperion the spectroradiometer has no atmospheric correction provided as a result of the atmosphere and background backscattering and absorption affecting radiance and reflectance measurements obtained by the satellite sensor. At these wavelengths the sensor provides for spectral signal major errors due to its high signal-to-noise ratio.

Table 6-2- STATISTICAL DATA FOR FIGURES

CASE	IMAGE SINGLE/COMB. DATES	TREND	BAND COMBINATIONS	REGRESSION PLOT	COEFFICIENT OF DETERMINATION	ALGORITHM VALIDATION	SCATTER PLOTS PREDICTED VS OBSERVED CONC.
GER 1500 RADIOMETER VS. TP CONC.	2-24-2006	L	(R770/R778)	6-7	0.65	N/A	N/A
	2-24-2006	P	(R519/R529)	6-8	0.24	6-9*	6-10
	2-24-2006	P	LOG (R519/R529	6-11	0.24	6-12*	6-13
HYPERION REFLECTANCE VS. TP CONC.	2-24-2006 and 5-12-2006	L	(R691/R671)	6-14	006	N/C	N/C
	5-12-2006 and 8-14-2006	PO	(R589/R569)	6-15	0.14	N/C	N/C
	2-24-2006 and 8-14-2006	P	R467/R529	6-16	0.49	6-17*	6-18

* with 5-12-2006 *in-situ* samples

L- linear
P- polynomial
E-exponential
PO- power

LOG- logarithmic
R- Reflectance

N/A- Not Applicable
N/C- Not Completed

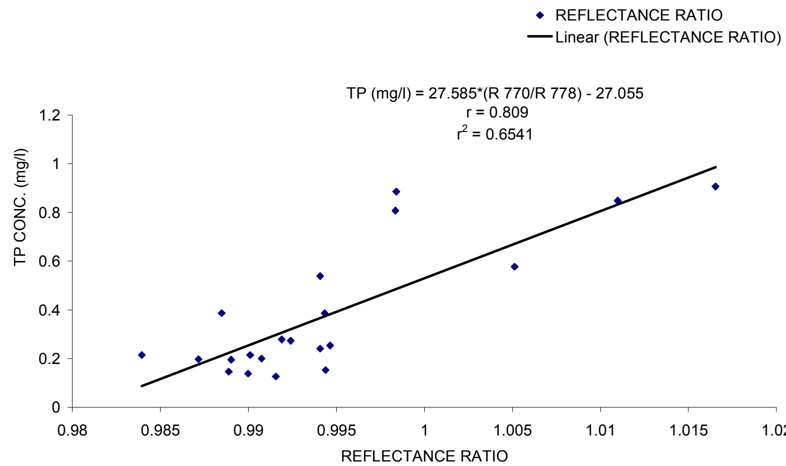

FIGURE 6-7: GER-1500 SPECTRORADIOMETER VS. TP (FEBRUARY 24, 2006) (LINEAR)

Figure 6-8 shows the polynomial correlation plot for the reflectance ratio obtained from bands 519 and 529-nanometers. The resulting coefficients of regression and determination are 0.44 and 0.24, respectively. Both results are considerably low making the algorithm obtained from this evaluation inadequate for our research.

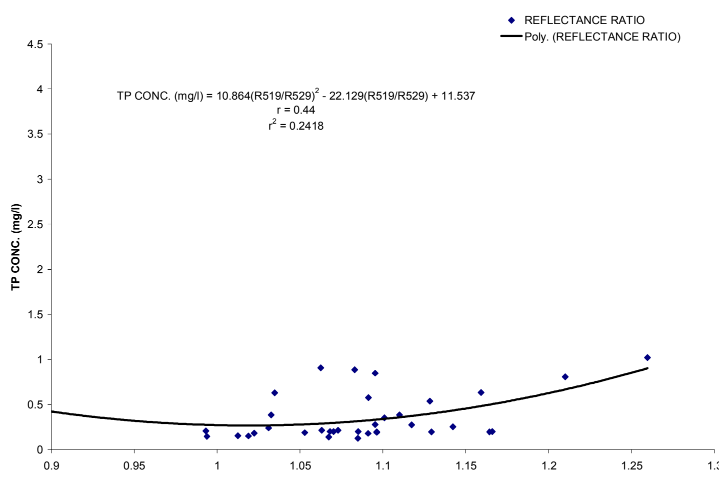

FIGURE 6-8: HYPERION REFLECTANCE VS. TP (POLYNOMIAL) (FEBRUARY 24, 2006) (Reflectance 519/Reflectance 529)

As shown in Figure 6-9 the validation completed for the predicted values with the May 12, 2006 *in situ* sample results is highly variable as for many of the stations evaluated the predicted results exceeded the observed values. For the remaining stations the predicted results were lower than the observed.

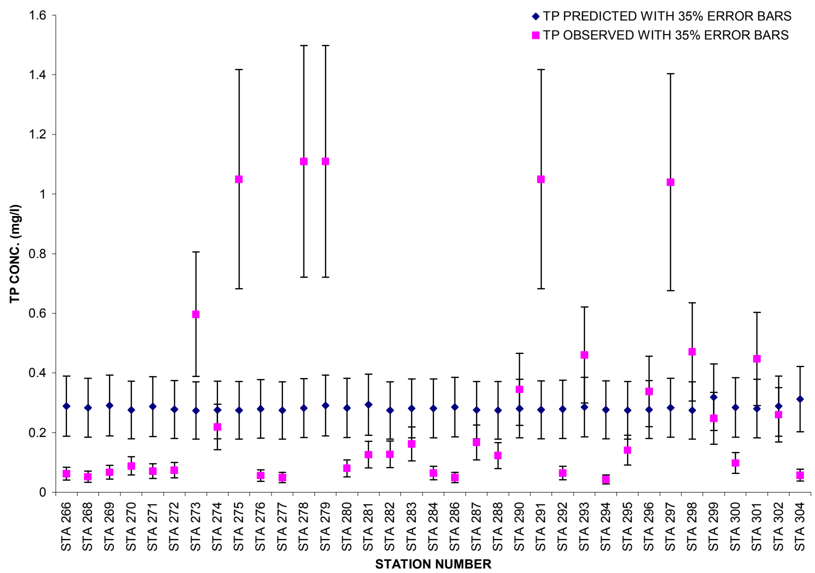

FIGURE 6-9: HYPERION REFLECTANCE VS. TP (FEBRUARY 24, 2006) ALGORITHM VALIDATION WITH 5-12- 2006 *IN-SITU* SAMPLES (Reflectance 529/ Reflectance 488)

Figure 6-10 shows the scatter plot after application of the selected algorithm vs. TP *in situ* samples. The predicted concentrations provided in the figure are virtually unchanged as compared to the observed values which make the algorithm useless.

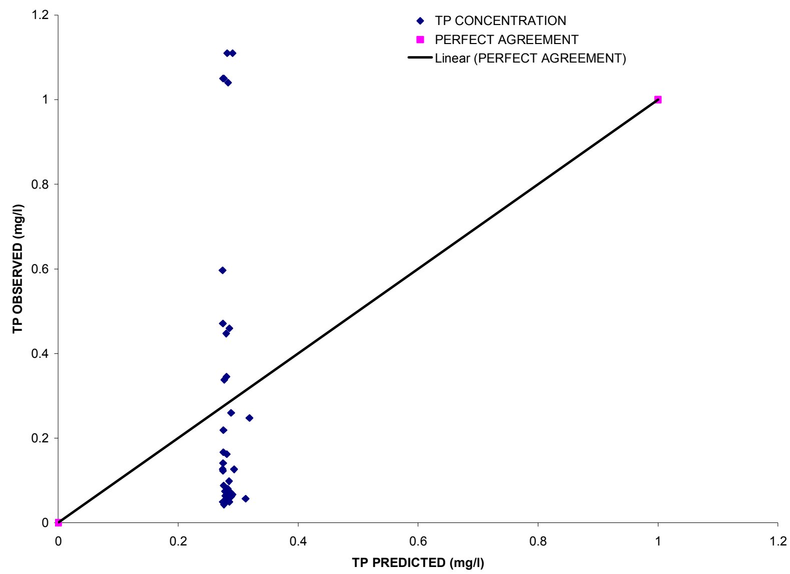

FIGURE 6-10: SCATTER PLOT FOR TP CONCENTRATION IMAGE ALGORITHM VS. 5-12- 2006 *IN SITU* SAMPLES (Reflectance 519/Reflectance 529)

Similar to Figure 6-8, Figure 6-11 shows the February 24, 2006 polynomial correlation results for the Hyperion remote sensing reflectance from the logarithmic reflectance ratios obtained from the 519 and the 529-nanometers bands wavelengths. The correlation also resulted in a similarly poor coefficient of determination (r^2 = 0.24), which establishes basically no relation between the TP values.

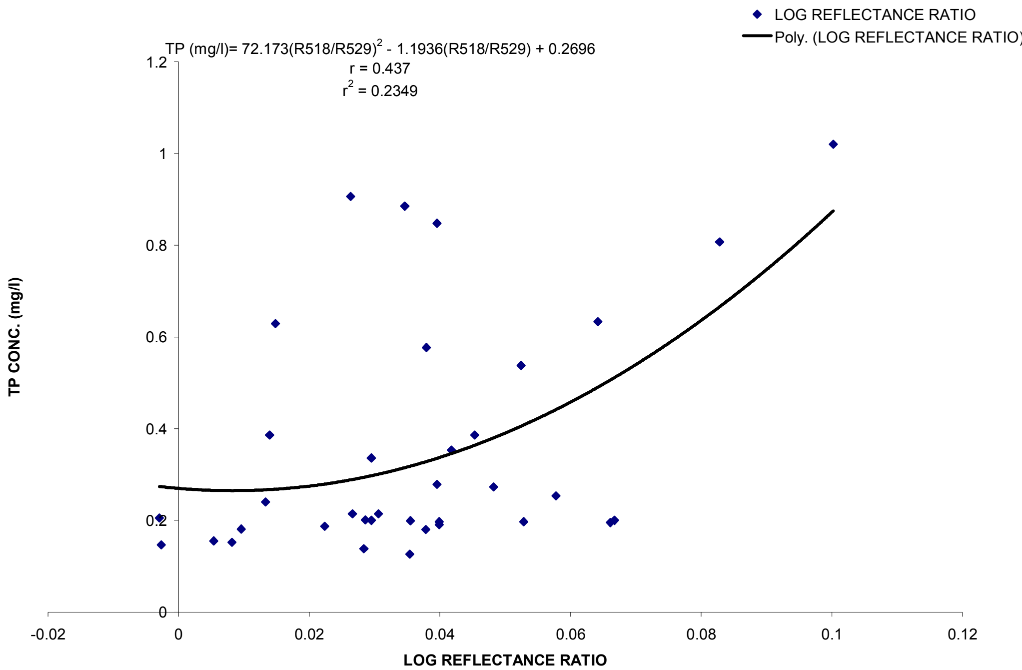

FIGURE 6-11: HYPERION REFLECTANCE VS. TP (FEBRUARY 24, 2006) (log Reflectance 519/log Reflectance 529)

Figure 6-12 provides the validation results for the predictive model after compared with the observed results. Such analysis virtually shows no validation as the predicted results are considerably distant from the observed values.

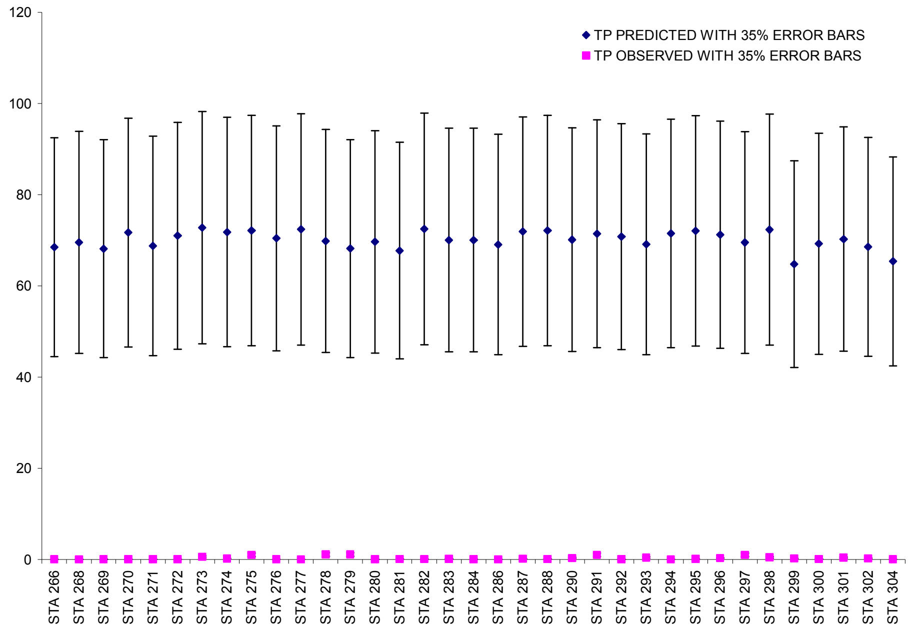

FIGURE 6-12: HYPERION REFLECTANCE VS. TP (FEBRUARY 24, 2006) ALGORITHM VALIDATION WITH 5-12- 2006 *IN-SITU* SAMPLES (log Reflectance 519/ log Reflectance 529)

Figure 6-13 shows the considerably overprediction of the TP concentration values with basically no relation provided.

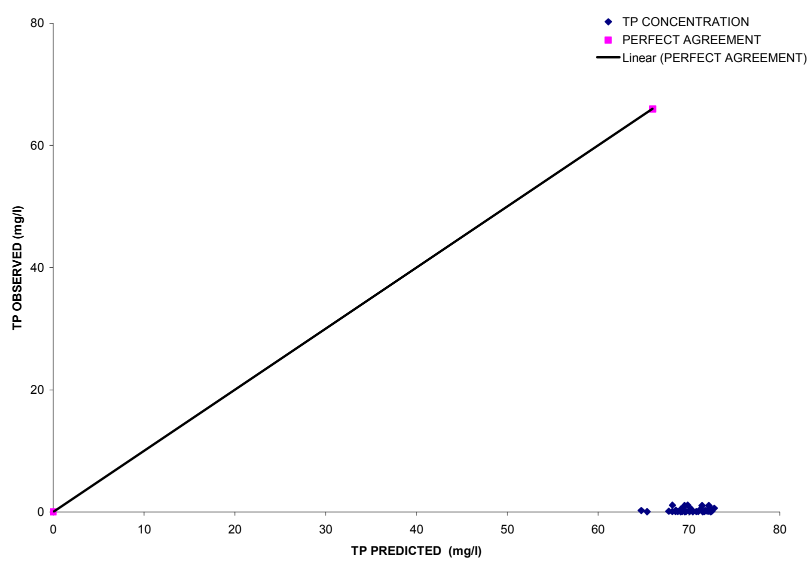

FIGURE 6-13: SCATTER PLOT FOR TP CONCENTRATION IMAGE ALGORITHM VS. IN SITU SAMPLES (log Reflectance 519/log Reflectance 529)

Figure 6-14 shows the combined February 24 and May 12, 2006 linear correlation results for the Hyperion remote sensing reflectance from the reflectance ratios obtained from the 691 band and the 671-nanometers bands wavelengths. The coefficient of determination obtained from this correlation is extremely low which automatically discards it from further analysis. Validation and scatter plots were not developed for this band combination.

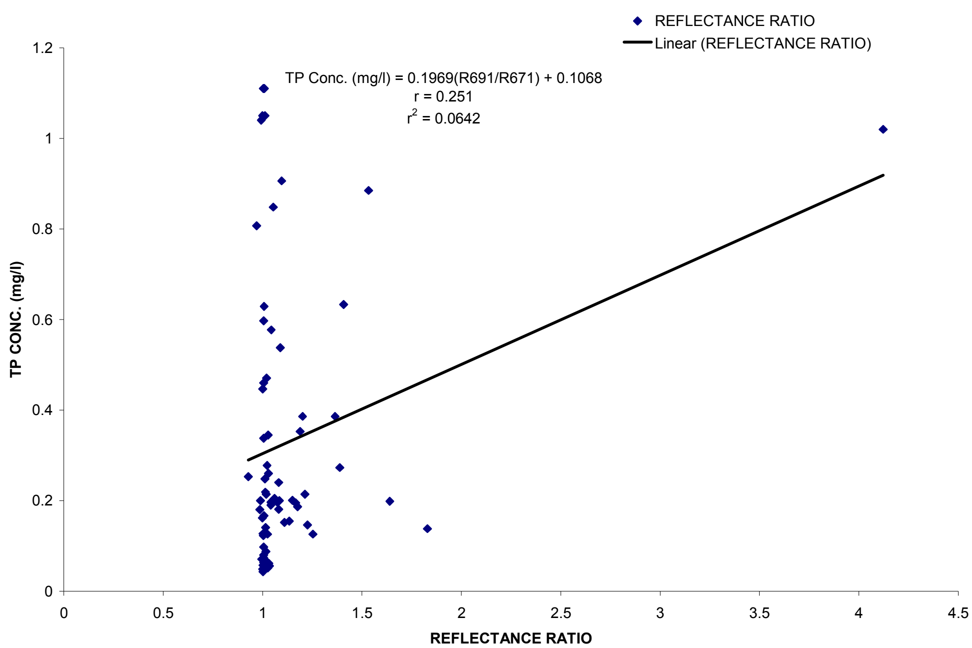

FIGURE 6-14: HYPERION REFLECTANCE VS. TP (LINEAR) (FEBRUARY 24 AND MAY 12, 2006 (Reflectance 691/Reflectance 671)

Figure 6-15 shows the combined May 12 and August 14, 2006 exponential correlation results for the Hyperion remote sensing reflectance from the reflectance ratios obtained from the 589 band and the 569-nanometers bands wavelengths. The coefficient of determination obtained from this correlation is very low which also discards it from further analysis. Validation and scatter plots were not developed for this band combination.

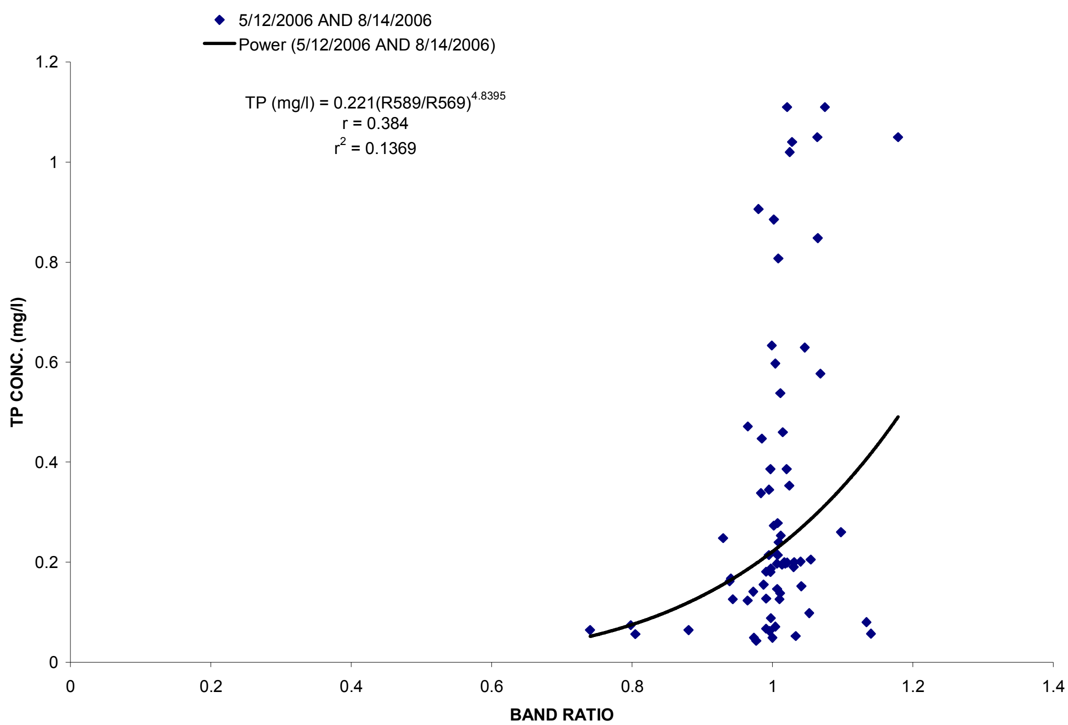

FIGURE 6-15: HYPERION REFLECTANCE VS. TP (EXPONENTIAL) (MAY 12 AND AUGUST 14, 2006 (Reflectance 589/Reflectance 569)

Figure 6-16 shows the scatter plot after application of the selected algorithm vs. TP *in situ* samples. This algorithm was selected after evaluation of the different correlation coefficients, validation and scatter plots.

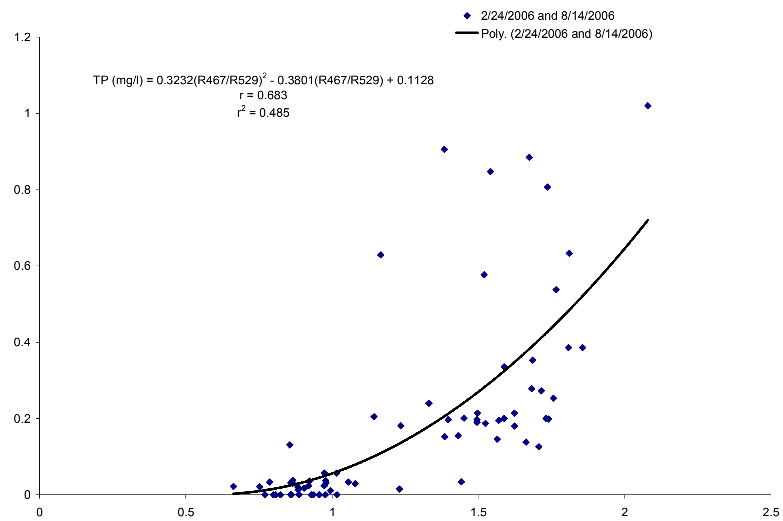

FIGURE 6-16: HYPERION REFLECTANCE VS. TP (LINEAR) (FEBRUARY 24 AND AUGUST 14, 2006 (Reflectance 467/Reflectance 529)

Figure 6-17 also shows that for many of the stations monitored showing TP concentrations under 0.2 mg/l the predicted concentrations are favorably validated with the observed values.

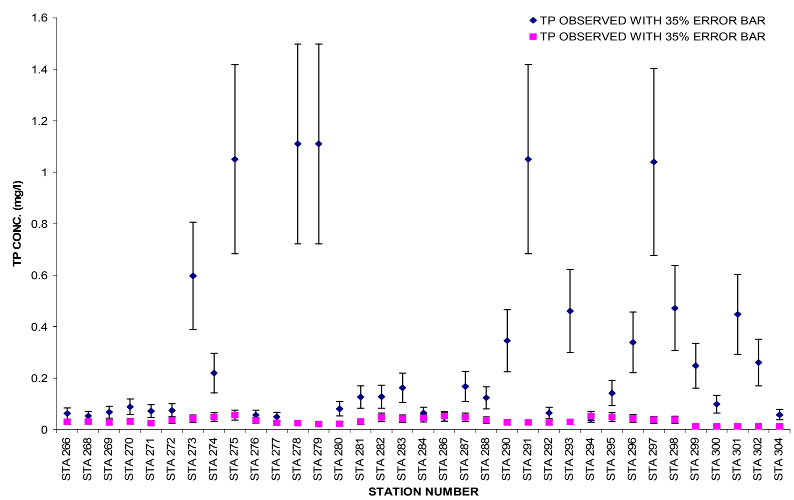

FIGURE 6-17: HYPERION REFLECTANCE VS. TP (FEBRUARY 24, 2006 AND AUGUST 14, 2006) ALGORITHM VALIDATION WITH 5-12-2006 *IN-SITU* SAMPLES (Reflectance 467/ Reflectance 529)

Figure 6-18 shows an underpredicition of the observed values, however, similar to previous analyses the predicted results are closer to the observed values for TP concentrations under 0.2 mg/l.

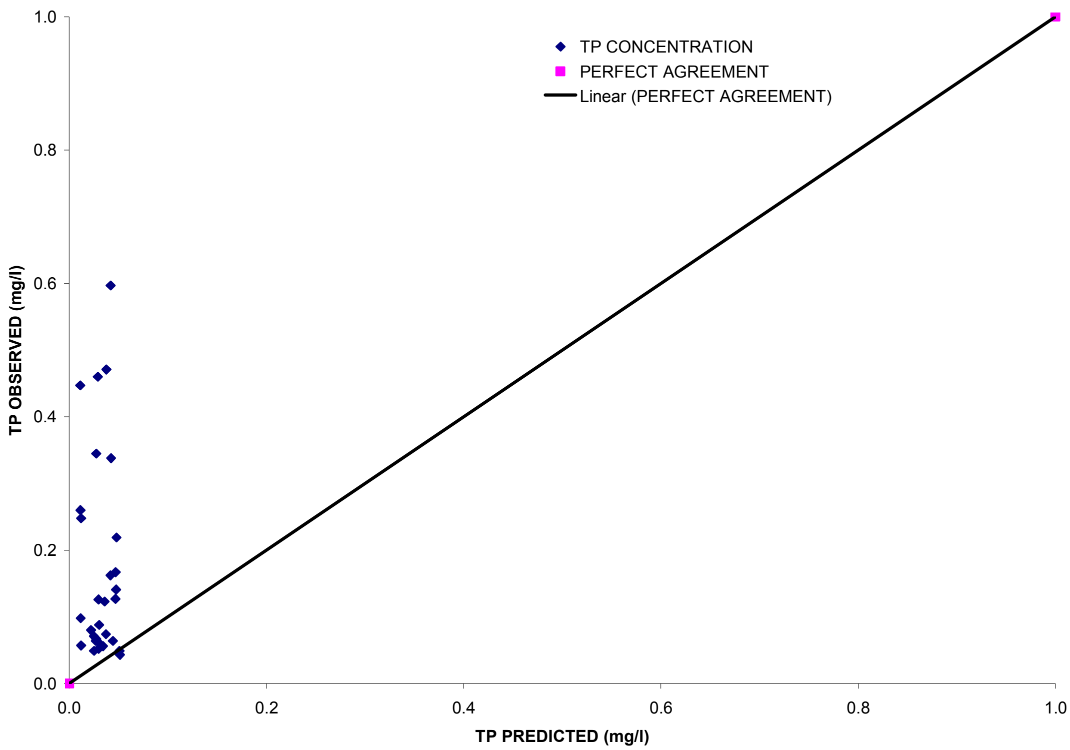

FIGURE 6-18: SCATTER PLOT FOR TP CONCENTRATION IMAGE ALGORITHM (FEBRUARY 24, 2006 AND AUGUST 14, 2006) VS. IN SITU SAMPLES (Reflectance 467/Reflectance 529)

6.4 Results Verification- TP Distribution Colored Maps

Figure 6-19 shows the February 24, 2006 TP distribution color map, from the Hyperion image transformed with the empirical algorithm. Figure 6-20 shows the color map developed by the COE's ICM model using the field sampling data for June 13, 1995. Both Hyperion and ICM Model data show other locations with high TP content (as compared with its national maximum value of 0.1 parts per million). With this algorithm the higher TP concentrations (>0.3 mg/l) extend to almost to the entire central and southeastern sections of the SJL covering the surface of one of the deep dredged pits and on the northern section where a vast mangrove inventory exist. Both maps show an overall uniform TP distribution at the lagoon ranging between the 0.1 and 0.2 mg/l.

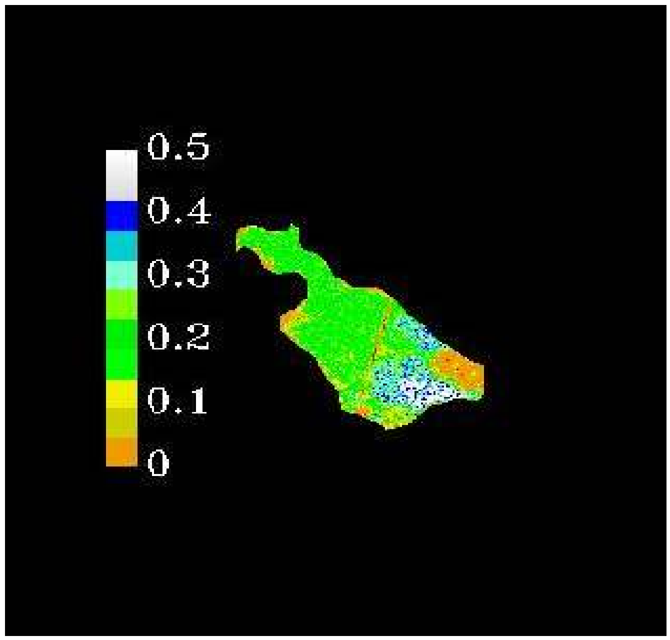

FIGURE 6-19: TP DISTRIBUTION COLOR MAP HYPERION SENSOR: FEBRUARY 24, 2006

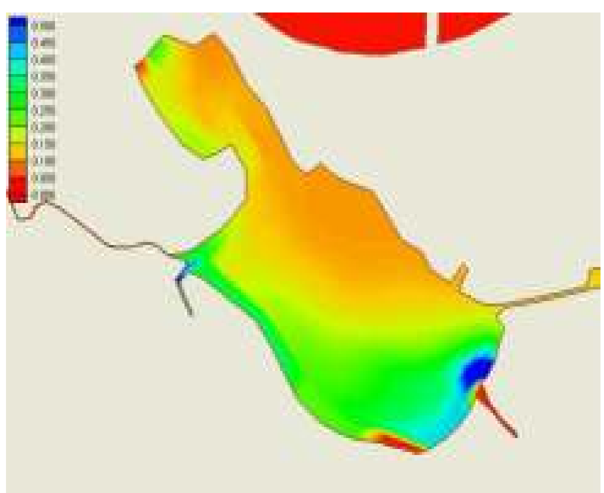

FIGURE 6-20: TP DISTRIBUTION COLOR MAP ICM CALIBRATED MODEL: JUNE 13, 1995

Figures 6-21 and 6-22 show the May 12, 2006, and August 14, 2006 TP distribution color maps, respectively, from the Hyperion image after application of the empirical algorithm. The phosphorus concentration in Figure 6-21 provides very similar red colors for the ranges between 0.0 and 0.02. Figures 6-22, and 6-24 show the color maps developed by the COE's ICM model using the field sampling data for August 26, 1995, and August 30, 1995, respectively. Both show uniform TP concentration throughout the lagoon resembling very low TP concentrations. All developed maps show high TP variability in the SJL at different time periods, particularly during the summer months, where lower concentrations dominate, as compared with the results observed during the spring where the water quality is poorer.

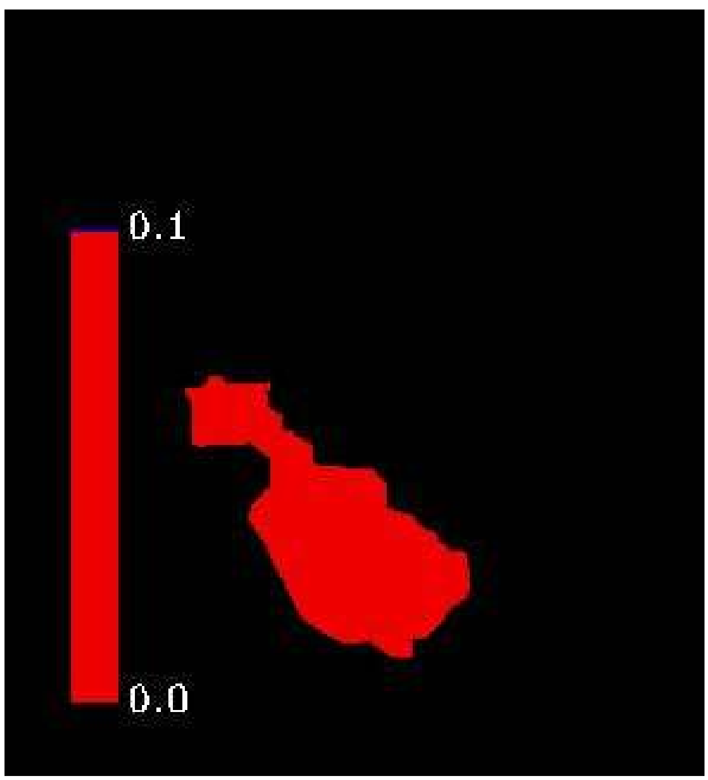

FIGURE 6-21: TP DISTRIBUTION COLOR MAP HYPERION SENSOR: MAY 12, 2006

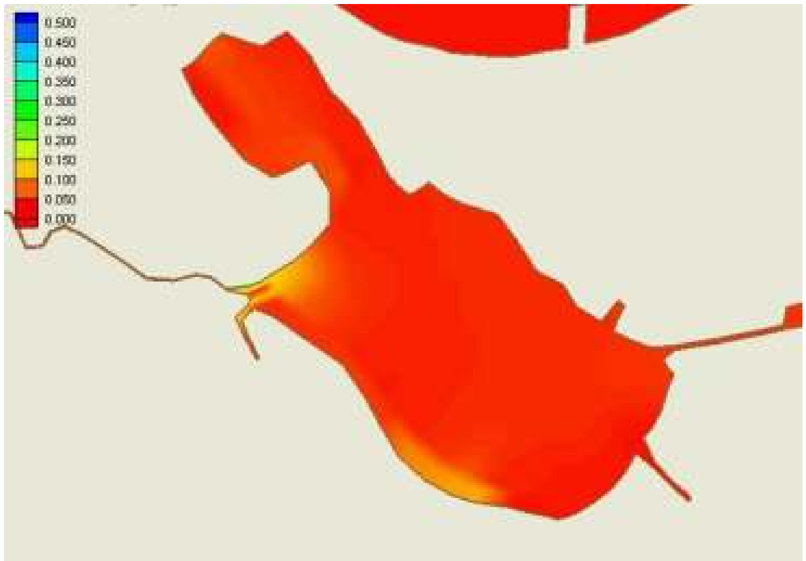

FIGURE 6-22: TP DISTRIBUTION COLOR MAP ICM CALIBRATED MODEL: AUGUST 26, 1995

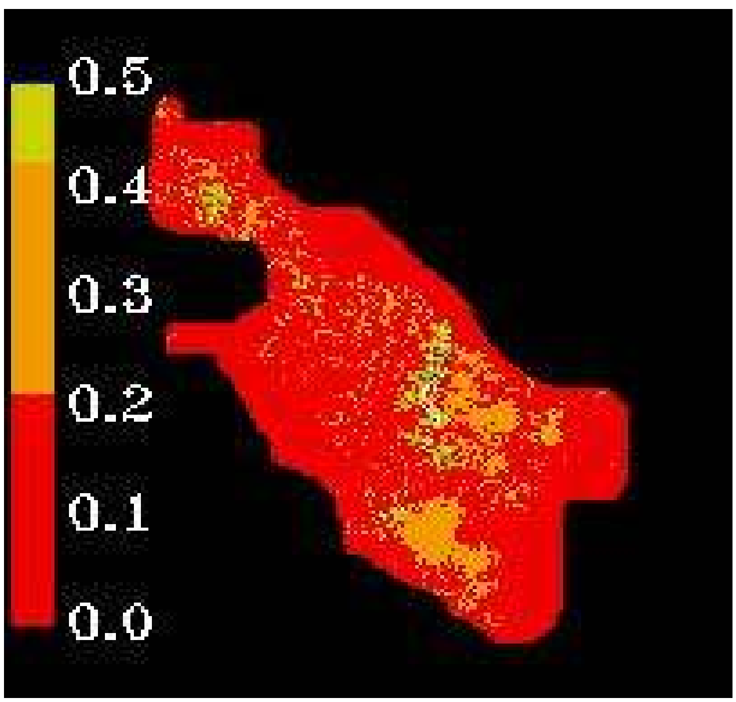

FIGURE 6-23: TP DISTRIBUTION COLOR MAP HYPERION SENSOR: AUGUST 14, 2006

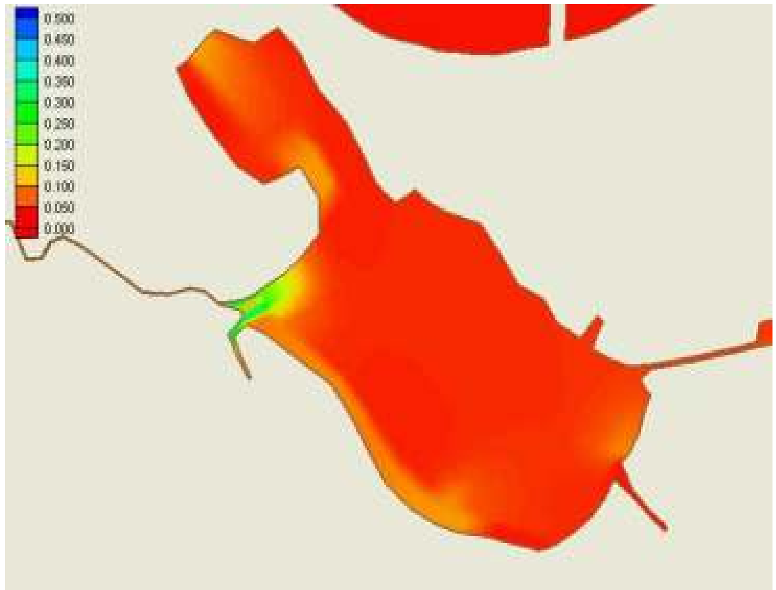

FIGURE 6-24: TP DISTRIBUTION COLOR MAP ICM CALIBRATED MODEL: AUGUST 30, 1995

6.5 Spectral Interference

6.5.1 Concrete Surface

Possible spectral interference in the Hyperion images from chemical constituents present in the SJL and from the Teodoro Moscoso bridge's concrete surface were evaluated as part of this study. While several sampling stations were located adjacent to the Teodoro Moscoso Bridge reflectance from the bridge road caused no significant effect on the total phosphorus results since concrete surfaces show reflectance spectra peaks in the short-wave infrared bands, and lowest in the 400-600 nm range, as shown in Figure 6-25 (Herold *et al.*, 2004).

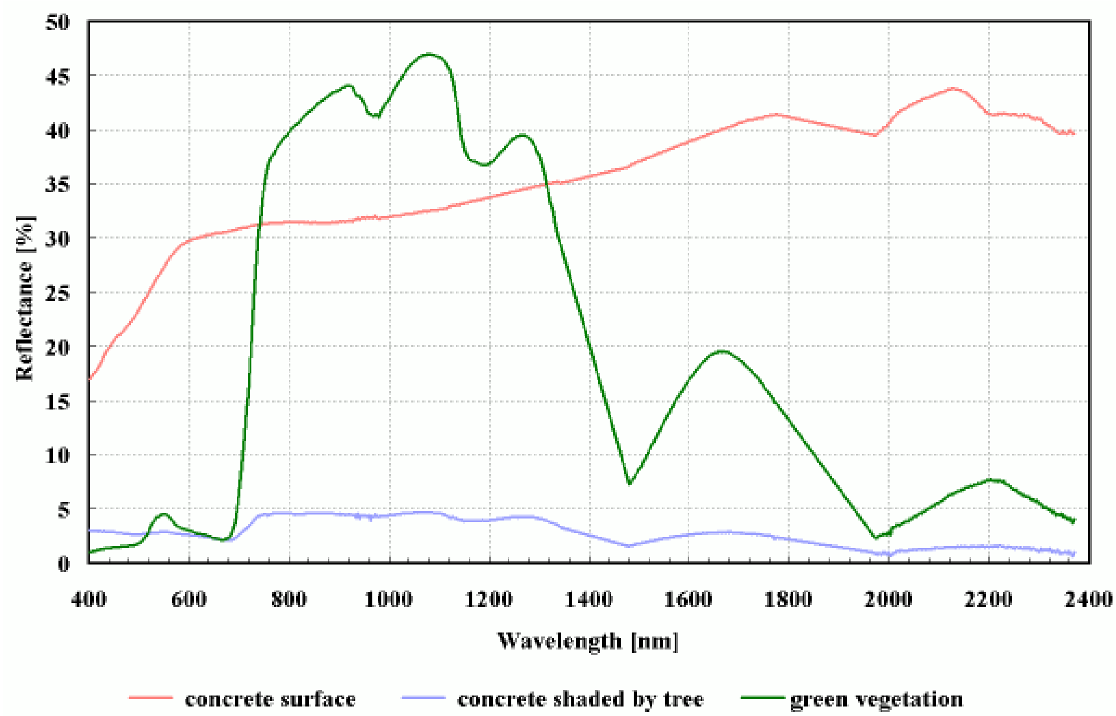

FIGURE 6-25: Spectral Signal: Concrete Surface (From Herold *et al.*, 2004)

6.5.2 Toxic Organic Constituents

None of the toxic organic components identified by the USGS during the 2002-2005 survey (See Appendix H for results) interferes with the TP reflectance spectral index. Table 6-4 details the parameter measured with its corresponding peak reflectance indexes.

TABLE 6-2: REFLECTANCE INDEXES FOR TOXIC PARAMETERS

PARAMETER	As	Ba	Cd	CN	Cu	Cr	Pb	Se	Hg	Ag	Zn
SPECTRAL INDICES (nm)	410	614	694	612	600	500	520	680	560	<400	380

(http://www.faqs.org/faqs/sci/chem-faq/part1/preamble.html)

6.5.3 CDOM

Possible interference with CDOM was also evaluated as part of this research. The reflectance ratio (R_{457}/R_{529}) used for the algorithm development in the San José Lagoon provides the best reflectance characteristics for TP within the blue region of the visible light spectrum. CDOM absorbs light and decreases reflectance in the visible portion of the spectrum, especially in the blue region (less than 500 nm) (Menzen *et al*, 2005). Thus, CDOM does not interfere with the TP spectral signal retrieved by the Hyperion sensor from the lagoon.

Based on the above none of the mentioned constituents interfere with the total phosphorus reflectance index used for the algorithm development.

7. CONCLUSIONS AND RECOMMENDATIONS

This research was conducted to develop an algorithm to determine total phosphorus concentrations at the San José Lagoon based on the total phosphorus reflectance characteristics. The results were verified with the results produced by the United States Army Corp of Engineers calibrated hydrodynamic water quality model previously developed in 1995 for the mentioned water system. The results of this study show that hyperspectral remote sensing technology has significant potential use for the water quality management of such impaired surface waters. The following conclusions are emphasized.

- The empirical algorithm developed was unable to determine actual TP concentrations at the San José Lagoon. However, the research results narrow the light spectrum range where the TP could be reflecting.
- Band ratios provide stronger correlations between Hyperion reflectance values and TP concentrations (within the 428-529 nm range of the visible region of the spectrum) in eutrophic water systems, and better correlations between field spectroradiometer reflectance results and TP concentrations (within the 770-780 nm range within the near infra-red region of the spectrum).
- While the coefficient of determination obtained from the statistical regressions of the 36 stations evaluated is slightly low (0.49) the empirical algorithm does well for the surveyed stations with resulting TP concentrations at or below 0.2 mg/l, however, it consistently underpredicts the results for exceeding values. Numerous sources can contribute to errors in the results estimates, including scene complexity, material

variability, atmospheric effects, sensor radiometric noise error, spatial point spread effects, and spectral combination selection.

- The resulting algorithm compares fairly well with the COE's ICM model, thus, it may be utilized in other hydraulically similar lagoons and lakes. Field data should be used to validate the algorithm in such water systems before its application. The results obtained should then be used to calibrate a water quality model for TP pollution control management purposes.
- In the absence of a unique spectral signal for total phosphorus in water additional research should be conducted for such determination. Our research suggests that such signal may be originated within the lower wavelengths of the visible light spectrum's blue region, or at even lower values within the ultra-violet spectral field. Other regions of the spectrum may be discarded for retrieval of the spectral signal for TP, significantly reducing time and efforts for similar purposes.

The following recommendations should be considered for further studies and research:

- The results produced by our research suggest that TP reflectance signal may lie approaching the ultraviolet region of the light spectrum. Additional research is needed in new hyperspectral remote sensing technology which may be able to retrieve spectral data in this region which the Hyperion is unable to produce.
- New approaches for the development of hydrodynamic water quality models for TP monitoring in surface water systems should be considered where its validation can be completed with the use of hyperspectral remote sensing technology. Representative field sampling stations should be selected to validate the spectral imagery developed by the satellite, or aircraft sensors, previous to the model's

validation. The use of aircraft hyperspectral sensors should be further evaluated in assuring that is as reliable as the Hyperion for the latter's capacity to detect the TP spectral signal at channels with similar wavelengths needed for the pollutant's recording. Model updating needs to be completed with a frequency for presence of additional point or non-point nutrients pollutant sources which the sensor will be able to identify.

- Future research should use hyperpsectral remote sensing for the monitoring of other water pollutants, such as: volatile organic chemicals, heavy metals, and contaminants of bacterial origin where few studies have been conducted.

Some of the limitations of the hyperspectral remote sensing technology applicability in the San José Lagoon are:

- While the Hyperion high spectral resolution is responsible for producing a signal related with total phosphorus concentrations, its applicability to smaller surface water systems may not result to be the best alternative due to its lower spatial resolution.
- The use of remote sensing in shallow turbid waters requires additional spectral corrections, through modeling, due to the reflectance misleading effect caused by the bottom albedo, organic matter, and suspended sediments.
- The Hyperion's low signal-to-noise ratio in several spectral bands produces negative reflectance values in the blue (400-500 nm) and infrared (800-1200 nm) regions.
- The Hyperion's lower spatial resolution impedes a precise modeling in smaller surface water systems. Hyperion's 30 meter X 30 meter spatial resolution is

particularly disadvantegeous for the San José Lagoon, which exhibits large variability in total phosphorus concentrations at certain time periods as compared to Hyperion's inability to monitor changes in water quality at close sampling stations. An aircraft with a hyperspectral sensor provided, such as the Compact Airborne Spectrographic Imager (CASI) may be a substitute for a satellite sensor where the spatial resolution inconveniences is considerably reduced.

- Applicability of the developed emprirical algorithm may be limited to similar tropical water systems in the absence of a unique spectral signal produced by total phosphorus which could be used to accurately predict TP water quality values.

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APPENDIX A

GLOSSARY OF TERMS

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Biological Oxygen Demand (BOD- is a chemical procedure for determining how fast biological organisms use up oxygen in a body of water.

Chemical Oxygen Demand (COD)- test is commonly used to indirectly measure the amount of organic compounds in water.

Contravariant Components- change in vector coordinates components under a change of plane basis.

Covariant Components- change in co-vector coordinates components under a change of plane basis.

Curvilinear Coordinate System- are a coordinate system for the Euclidean space based on some transformation that converts the standard Cartesian coordinate system to a coordinate system with the same number of coordinates in which the coordinate lines are curved.

Dissolved Organic Carbon (DOC)- the organic matter that is able to pass through a filter (filters generally range in size between 0.7 and 0.22 um).

Dissolved Organic Phosphorus (DOP)- organic fraction of dissolved phosphorus.

Dissolved Oxygen (DO)- relative measure of the amount of oxygen that is dissolved or carried in water.

Estuary- is a partially enclosed body of water along the coast where freshwater from rivers and streams meet and mix with salt water from the ocean (**http://www.epa.gov/nep/about1.htm**).

Euclidean Space- two or three dimensional space, characterized by an infinite extent along each dimension and a constant distance between any pair of parallel lines.

Eutrophication- is an increase in chemical nutrients, typically compounds containing nitrogen or phosphorus in an ecosystem, and may occur on land or in water.

Fecal Coliform Bacteria- are facultatively anaerobic bacteria, rod-shaped, gram negative, non-sporulating bacteria. They indicate the presence of sewage contamination of a waterway and the possible presence of other pathogenic organisms.

Hyperspectral Remote Sensing- remote sensing that uses many (typically > 200) narrowly defined spectral channels (bands) with high radiometric resolution.

Irradiance- power of electromagnetic radiation at a surface, per unit area. "Irradiance" is used when the electromagnetic radiation is incident on the surface.

Particulate Organic Carbon- unfiltered portion of the organic carbon.

Particulate Organic Phosphorus- unfiltered portion of the organic phosphorus.

Phosphorus- common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent.

Phytoplankton- autotrophic component of the plankton community.

Pixel- digital image consists of discrete picture elements originated from a digital image. Associated with each pixel is a number represented as DN (Digital Number) that describes the average radiance of relatively small area within a scene.

Plankton- organisms drifting in the water column of oceans, seas, and bodies of fresh water.

Radiance and spectral radiance- radiometric measures that describe the amount of light that passes through or is emitted from a particular area, and falls within a given solid angle in a specified direction**.**

Radiometric resolution- in remotely sensed data is defined as the amount of energy required to increase a pixel value by digital number.

Remote Sensing (RS)- is the acquisition of information about an object without physical contact (Colwell, 1983).

Reflectance- the ratio of incident flux on a sample surface to reflected flux from the surface.

Remote Sensing Reflectance- ratio of water leaving radiance relative to the surface radiance.

Salinity- dissolved salt content of a body of water.

Signal to Noise Ratio (SNR)- rate at which the recorded spectral signal appearing as a pixel can be useable and how much is unwanted distortion or noise.

Spatial resolution- refers to the size of the smallest object that can be resolved on the ground. In a digital image, the resolution is limited by the pixel size.

Spectral resolution- denotes the ability of a sensor to define fine wavelength intervals (Campbell, 2002).

Total Inorganic Phosphorus- inorganic fraction of dissolved phosphorus and referred as filtered reactive phosphorus.

Total Phosphorus (TP)- measurement of all the various forms of phosphorus that are found in a water sample.

Total Suspended Solids (TSS)- amount of particles that suspend in a sample of water.

Zooplankton- heterotrophic type of plankton.

APPENDIX B

FIELD SAMPLING SURVEY RESULTS

AUGUST AND NOVEMBER, 2005

FEBRUARY, MAY, AND AUGUST, 2006

eqlab
ENVIRONMENTAL QUALITY LABORATORIES, INC.

August 17, 2005

Eng. Luis Campos
INSTITURO DE RECURSOS DE AGUA
P.O. Box 9040
Mayaguez, PR 00681

I hereby certify that the results reported for Eq Lab Sample #: 738607 to 738644 have been reviewed by me and are correct as presented herein.

Ledo. Carlos Galindo Velázquez
Interim Laboratory Director

A 1037133

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TELS. 725-0333, 725-3709

To:	INSTITUTO DE RECURSOS DE AGUA P.O. BOX 9040 MAYAGUEZ PR 00681

Attn:	ENG. LUIS CAMPOS
Source:	**SAMPLE # 266**
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Sample Number:	**738607**	Collected Date & Time:	**08/07/2005**	08:20		Date of Report:	8/17/05
Work Order:	1511-90-02	Received Date & Time:	08/08/2005	10:35		Collected By:	LCAMPOS
Delivery Slip:	2005-07737	Temperature at Arrival:	2 °C			Eqlab Rep.:	ELEVY
Folder Number:	68259					Proposal Number:	6779 - 1

Remarks:

				Limits		Analysis			Prep Method		
Parameter	Method	Results	Units	LOD	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	0.0141	mg/L	0.01	--	08/09/2005	08:18	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.109	mg/L	0.010	--	08/17/2005	14:28	DMALDONADO	--	--	N/A

CARLOS GALINDO VELAZQUEZ Químico Licenciado Puerto Rico LICENCIA NUM.

To:	INSTITUTO DE RECURSOS DE AGUA P.O. BOX 9040 MAYAGUEZ PR 00681

Attn:	ENG. LUIS CAMPOS
Source:	**SAMPLE # 267**
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	

ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Page 1 of 1

Sample Number:	**738608**	Collected Date & Time:	**08/07/2005**	08:26		Date of Report:	8/17/05
Work Order:	1511-90-02	Received Date & Time:	08/08/2005	10:35		Collected By:	LCAMPOS
Delivery Slip:	2005-07737	Temperature at Arrival:	2 °C			Eqlab Rep.:	ELEVY
Folder Number:	68259					Proposal Number:	6779 - 1

Remarks

Parameter	Method	Results	Units	Limits		Analysis			Prep Method		
				LOD	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	0.0178	mg/L	0.01	--	08/09/2005	08:18	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.173	mg/L	0.010	--	08/17/2005	14:28	DMALDONADO	--	--	N/A

CARLOS GALINDO VELAZQUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA NUM.

Certified by

The results presented herein meet all NELAC requirements.

ND = Not Detected MCL = Maximum Contaminant Level BDL = Below Detection Limit DNI = Does Not Ignite LOD = Limit of Detection N/A = Not Applicable
MO = Monitoring Only. All results are calculated on a wet weight basis unless otherwise stated.

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458. TELS. 725-5333, 725-3708

To:	INSTITUTO DE RECURSOS DE AGUA P.O. BOX 9040 MAYAGUEZ PR 00681

Attn:	ENG. LUIS CAMPOS
Source:	**SAMPLE # 292**
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Page 1 of 1

Sample Number:	**738631**	Collected Date & Time:	**08/07/2005**	11:13	Date of Report:	8/17/05
Work Order:	1511-90-02	Received Date & Time:	08/08/2005	10:35	Collected By:	LCAMPOS
Delivery Slip:	2005-07737	Temperature at Arrival:	2 °C		Eqlab Rep.:	ELEVY
Folder Number:	68259				Proposal Number:	6779 - 1

Remarks:

Parameter	Method	Results	Units	Limits		Analysis			Prep Method		
				LOD	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	08/09/2005	08:44	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.132	mg/L	0.010	--	08/17/2005	14:28	DMALDONADO	--	--	N/A

ND = Not Detected MCL = Maximum Contaminant Level BDL = Below Detection Limit DNI = Does Not Ignite LOD = Limit of Detection N/A = Not Applicable
MO = Monitoring Only. All results are calculated on a wet weight basis unless otherwise stated.

nelac — The results presented herein meet all NELAC requirements eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

November 11, 2005

Mr. Luis Campos
INSTITUTO DE RECURSOS DE AGUA
P.O. Box 9040
Mayaguez, PR 00681

I hereby certify that the results reported for Eq Lab Sample #: 772060 to 772099 have been reviewed by me and are correct as presented herein.

Lcdo. Carlos Galindo Velázquez
Interim Laboratory Director

CARLOS GALINDO VELAZQUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA NUM. 3491

A 1049784

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TELS. 725-5333, 725-3708

To: INSTITUTO DE RECURSOS DE AGUA
P.O. BOX 9040
MAYAGUEZ PR 00681

Attn:	ENG. LUIS CAMPOS
Source:	266
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Page 1 of 1

Sample Number:	772060	Collected Date & Time:	11/06/2005	08:34	Date of Report:	11/11/05
Work Order:	1511-90-02	Received Date & Time:	11/07/2005	10:35	Collected By:	LCAMPOS
Delivery Slip:	2005-11109	Temperature at Arrival:	3 °C		Eqlab Rep.:	ELEVY
Folder Number:	71824				Proposal Number:	6779 - 1

Remarks:

				Limits		Analysis			Prep Method		
Parameter	Method	Results	Units	LOD	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	11/07/2005	16:29	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.088	mg/L	0.010	--	11/11/2005	09:06	LHERNAN	--	--	N/A

CARLOS GALINDO VELAZQUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA Núm. 3491

ND = Not Detected MCL = Maximum Contaminant Level BDL = Below Detection Limit DNI = Does Not Ignite LOD = Limit of Detection NA = Not Applicable
MO = Monitoring Only. All results are calculated on a wet weight basis unless otherwise stated.

nelac
The results presented herein meet all NELAC requirements

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TELS. 725-5333, 725-3708

To:	INSTITUTO DE RECURSOS DE AGUA P.O. BOX 9040 MAYAGUEZ PR 00681
Attn:	ENG. LUIS CAMPOS
Source:	267
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Sample Number:	**772061**	Collected Date & Time:	**11/06/2005**	08:39	Date of Report:	11/11/05
Work Order:	1511-90-02	Received Date & Time:	11/07/2005	10:35	Collected By:	LCAMPOS
Delivery Slip:	2005-11109	Temperature at Arrival:	3 °C		Eqlab Rep.:	ELEVY
Folder Number:	71824				Proposal Number:	6779 - 1

Remarks

Parameter	Method	Results	Units	Limits: LOD	Limits: MCL	Analysis: Date	Analysis: Time	Analysis: By	Prep Method: Date	Prep Method: By	Prep Method: Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	11/07/2005	16:29	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.089	mg/L	0.010	--	11/11/2005	09:06	LHERNAN	--	--	N/A

CARLOS GALINDO VELAZQUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA NUM.

ND = Not Detected MCL = Maximum Contaminant Level BDL = Below Detection Limit TNTC = Too Numerous To Count LOD = Limit of Detection N/A = Not Applicable
All results are calculated on a wet weight basis unless otherwise stated.

nelac

The results presented herein meet all NELAC requirements

To: INSTITUTO DE RECURSOS DE AGUA
P.O. BOX 9040
MAYAGUEZ PR 00681

Attn: ENG. LUIS CAMPOS
Source: 268
Project Name: INTERNAL DATA
Facility: SAN JOSE LAGOON
Description: SURFACE WATER - Grab
Client Ref. #: N/A
PWSID:

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Sample Number:	**772062**	Collected Date & Time:	**11/06/2005** 08:42	Date of Report:	11/11/05
Work Order:	1511-90-02	Received Date & Time:	11/07/2005 10:35	Collected By:	LCAMPOS
Delivery Slip:	2005-11109	Temperature at Arrival:	3 °C	Eqlab Rep.:	ELEVY
Folder Number:	71824			Proposal Number:	6779 - 1

Remarks:

				Limits		Analysis			Prep Method		
Parameter	Method	Results	Units	LOD	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	11/07/2005	16:30	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.062	mg/L	0.010	--	11/11/2005	09:06	LHERNAN	--	--	N/A

CARLOS GALINDO VELAZQUEZ
Químico Licenciado
LICENCIA NUM.

nelac

The results presented herein meet all NELAC requirements

ND = Not Detected MCL = Maximum Contaminant Level BDL = Below Detection Limit DNI = Does Not Ignite LOD = Limit of Detection N/A = Not Applicable
MO = Monitoring Only. All results are calculated on a wet weight basis unless otherwise stated.

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TELS. 725-5333, 725-9708

eqlab
ENVIRONMENTAL QUALITY LABORATORIES, INC.

February 28, 2006

Eng. Luis Campos
INSTITUTO DE RECURSOS DE AGUA
P.O. Box 9040
Mayaguez, PR 00681

I hereby certify that the results reported for EQ Lab Sample #809132 to #809171 have been reviewed by me and are correct as presented herein.

Lic. Sonia Richardo Rodriguez
Interim Laboratory Director

SONIA RICARDO RODRIGUEZ
Estado Libre Asociado de Puerto Rico
LICENCIA NUM. 4538

A 1071260

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TEL. (787) 268-6420 FAX (787) 268-6480

To: INSTITUTO DE RECURSOS DE AGUA
P.O. BOX 9040
MAYAGUEZ PR 00681

Attn: ENG. LUIS CAMPOS
Source: **SAMPLE #30 266**
Project Name: INTERNAL DATA
Facility: SAN JOSE LAGOON
Description: SURFACE WATER - Grab
Client Ref. #: N/A
PWSID:
Permit No.:

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Sample Number:	**809155**	Collected Date & Time:	**02/24/2006** 16:05	Date of Report:	02/28/2006
Work Order:	1511-90-02	Received Date & Time:	02/24/2006 17:47	Collected By:	LCAMPOS
Delivery Slip:	2006-01776	Temperature at Arrival:	3 °C	Eqlab Rep.:	ELEVY
Folder Number:	75684			Proposal Number:	6779 - 1

Remarks:

Parameter	Method	Results	Units	Limits		Analysis			Prep Method		
				MDL	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	02/26/2006	10:38	MBENITEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.205	mg/L	0.010	--	02/28/2006	09:30	DMALDONADO	--	--	N/A

SONIA PICHARDO RODRIGUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA NUM. 4538

ND = Not Detected MCL = Maximum Contaminant Level BDL = Below Detection Limit DNI = Does Not Ignite MDL = Minimum Detection Limit N/A = Not Applicable
MO = Monitoring Only. All results are calculated on a wet weight basis unless otherwise stated.

nelac — The results presented herein meet all NELAC requirements

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TEL (787) 288-6420 Fax (787) 288-6485

To:	INSTITUTO DE RECURSOS DE AGUA P.O. BOX 9040 MAYAGUEZ PR 00681
Attn:	ENG. LUIS CAMPOS
Source:	**SAMPLE #26 207**
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	
Permit No.:	

Laboratory Test Report

Page 1 of 1

Sample Number:	**809150**	Collected Date & Time:	**02/24/2006**	15:40	Date of Report:	02/28/2006
Work Order:	1511-90-02	Received Date & Time:	02/24/2006	17:47	Collected By:	LCAMPOS
Delivery Slip:	2006-01776	Temperature at Arrival:	3 °C		Eqlab Rep.:	ELEVY
Folder Number:	75684				Proposal Number:	6779 - 1

Remarks:

				Limits		Analysis			Prep Method		
Parameter	Method	Results	Units	MDL	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	02/26/2006	10:31	MBENITEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.382	mg/L	0.010	--	02/28/2006	09:58	DMALDONADO	--	--	N/A

Certified by

The results presented herein meet all NELAC requirements

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458. TEL. (787) 288-6420 Fax (787) 288-6465

To:	INSTITUTO DE RECURSOS DE AGUA P.O. BOX 9040 MAYAGUEZ PR 00681
Attn:	ENG. LUIS CAMPOS
Source:	**SAMPLE 023 268**
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	
Permit No.:	

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Sample Number:	**809147**	Collected Date & Time:	**02/24/2006**	15:25	Date of Report:	02/28/2006
Work Order:	1511-90-02	Received Date & Time:	02/24/2006	17:47	Collected By:	LCAMPOS
Delivery Slip:	2006-01776	Temperature at Arrival:	3 °C		Eqlab Rep.:	ELEVY
Folder Number:	75684				Proposal Number:	6779 - 1

Remarks:

Parameter	Method	Results	Units	Limits		Analysis			Prep Method		
				MDL	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	02/26/2006	10:28	MBENITEZ	--	--	N/A
Total Phosphorus	EPA 365.3	1.02	mg/L	0.010	--	02/28/2006	09:58	DMALDONADO	--	--	N/A

Certified by

nelac

The results presented herein meet all NELAC requirements

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TEL. (787) 288-6420 Fax (787) 288-6465

eqlab
ENVIRONMENTAL QUALITY LABORATORIES, INC.

June 7, 2006

Eng. Luis Campos
INSTITUTO DE RECURSOS DE AGUA
P.O. Box 9040
Mayagüez, Puerto Rico 00681

I hereby certify that the results reported for Eq Lab Sample #: 847290 to 847329, have been reviewed by me and are correct as presented herein.

Lcda. Sonia Pichardo Rodríguez
Interim Laboratory Director

SONIA PICHARDO RODRIGUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA NUM. 4538

A 1089249

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TEL. (787) 288-6420 FAX (787) 288-6465

To: INSTITUTO DE RECURSOS DE AGUA
P.O. BOX 9040
MAYAGUEZ PR 00681

Attn:	ENG. LUIS CAMPOS
Source:	SAMPLE #1 (266)
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	
Permit No.:	

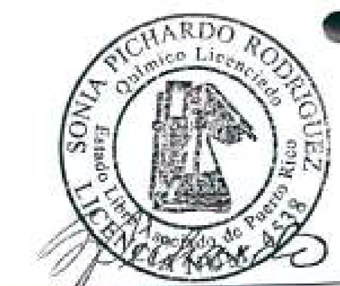
eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Sample Number:	847290	Collected Date & Time:	06/03/2006	09:35	Date of Report:	06/07/2006
Work Order:	1511-90-02	Received Date & Time:	06/03/2006	14:15	Collected By:	LCAMPOS
Delivery Slip:	2006-05116	Temperature at Arrival:	3 °C		Eqlab Rep.:	ELEVY
Folder Number:	79200				Proposal Number:	6779 - 1

Remarks:

Parameter	Method	Results	Units	Limits MDL	Limits MCL	Analysis Date	Analysis Time	Analysis By	Prep Method Date	Prep Method By	Prep Method Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	06/04/2006	13:37	MBENITEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.062	mg/L	0.010	--	06/07/2006	10:13	DMALDONADO	--	--	N/A



Certified by

ND = Not Detected MCL = Maximum Contaminant Level BDL = Below Detection Limit DNI = Does Not Ignite MDL = Minimum Detection Limit NA = Not Applicable
MO = Monitoring Only. All results are calculated on a wet weight basis unless otherwise stated.

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TEL. (787) 288-6420 Fax (787) 288-6465

To: INSTITUTO DE RECURSOS DE AGUA
P.O. BOX 9040
MAYAGUEZ PR 00681

Attn: ENG. LUIS CAMPOS
Source: SAMPLE #10 (267)
Project Name: INTERNAL DATA
Facility: SAN JOSE LAGOON
Description: SURFACE WATER - Grab
Client Ref. #: N/A
PWSID:
Permit No.:

Laboratory Test Report

Page 1 of 1

Sample Number:	847291	Collected Date & Time:	06/03/2006 09:45	Date of Report:	06/07/2006
Work Order:	1511-90-02	Received Date & Time:	06/03/2006 14:15	Collected By:	LCAMPOS
Delivery Slip:	2006-05116	Temperature at Arrival:	3 °C	Eqlab Rep.:	ELEVY
Folder Number:	79200			Proposal Number:	6773 - 1

Remarks:

Parameter	Method	Results	Units	Limits: MDL	Limits: MCL	Analysis: Date	Analysis: Time	Analysis: By	Prep Method: Date	Prep Method: By	Prep Method: Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	06/04/2006	13:38	MBENITEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.253	mg/L	0.010	--	06/07/2006	09:37	DMALDONADO	--	--	N/A

SONIA PICHARDO RODRIGUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA NUM. 4535

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458, TEL. (787) 288-6420 Fax (787) 288-6466

To: INSTITUTO DE RECURSOS DE AGUA
P.O. BOX 9040
MAYAGUEZ PR 00681

Attn: ENG. LUIS CAMPOS
Source: SAMPLE #11 (268)
Project Name: INTERNAL DATA
Facility: SAN JOSE LAGOON
Description: SURFACE WATER - Grab
Client Ref. #: N/A
PWSID:
Permit No.:

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Sample Number:	847292	Collected Date & Time:	06/03/2006	09:57	Date of Report:	06/03/2006
Work Order:	1511-00-02	Received Date & Time:	06/03/2006	14:15	Collected By:	LCAMPOS
Delivery Slip:	2006-05116	Temperature at Arrival:	3 °C		Eqlab Rep.:	ELEVY
Folder Number:	79200				Proposal Number:	6779 - 1

Remarks:

Parameter	Method	Results	Units	Limits MDL	Limits MCL	Analysis Date	Analysis Time	Analysis By	Prep Method Date	Prep Method By	Prep Method Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	06/04/2006	13:39	MBENITEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.052	mg/L	0.010	--	06/07/2006	10:13	DMALDONADO	--	--	N/A

SONIA PICHARDO RODRIGUEZ
Químico Licenciado
Estado Libre Asociado Puerto Rico
LICENCIA NUM. 4538

August 25, 2006

Eng. Luis Campos
INSTITUTO DE RECURSOS DE AGUA
PO Box 51129
Toa Baja, PR 00950

I hereby certify that the results reported for Eq Lab Sample: #882035, #882047 to #882085 have been reviewed by me and are correct as presented herein.

Lcdo. Sonia Pichardo Rodríguez
Interim Laboratory Director

A 1098375

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458. TELS. (787) 288-6420 , FAX (787) 288-6465

To: INSTITUTO DE RECURSOS DE AGUA
P.O. BOX 51124
TOA BAJA PR 00950

Attn: ENG. LUIS CAMPOS
Source: 266
Project Name: INTERNAL DATA
Facility: SAN JOSE LAGOON
Description: SURFACE WATER - Grab
Client Ref. #: N/A
PWSID:
Permit No.:

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Page 1 of 1

Sample Number:	**882035**	Collected Date & Time:	**08/14/2006** 14:40	Date of Report:	8/25/06
Work Order:	1511-90-02	Received Date & Time:	08/14/2006 18:30	Collected By:	LCAMPOS
Delivery Slip:	2006-08315	Temperature at Arrival:	3 °C	Eqlab Rep.:	ELUVY
Folder Number:	82717			Proposal Number:	6779 - 1

Remarks:

				Limits		Analysis			Prep Method		
Parameter	Method	Results	Units	MDL	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	08/15/2006	16:07	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	BDL	mg/L	0.010	--	08/24/2006	14:16	DMALDONADO	--	--	N/A

SONIA PICHARDO RODRIGUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA NUM. 4338

nelac

ENVIRONMENTAL QUALITY LABORATORIES, INC. P.O. BOX 11458, SANTURCE, P.R. 00910-1458. TEL. (787) 288-6420 Fax (787) 288-6465

To:	INSTITUTO DE RECURSOS DE AGUA P.O. BOX 51129 TOA BAJA PR 00950

Attn:	ENG. LUIS CAMPOS
Source:	267
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	
Permit No.:	

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Page 1 of 1

Sample Number:	**882047**	Collected Date & Time:	**08/14/2006**	14:45	Date of Report:	8/25/06
Work Order:	1511-90-02	Received Date & Time:	08/14/2006	18:30	Collected By:	LCAMPOS
Delivery Slip:	2006-08315	Temperature at Arrival:	3 °C		Eqlab Rep.:	ELEVY
Folder Number:	82717				Proposal Number:	6779 - 1

Remarks:

Parameter	Method	Results	Units	Limits: MDC	Limits: MCL	Analysis: Date	Analysis: Time	Analysis: By	Prep Method: Date	Prep Method: By	Prep Method: Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	08/15/2006	16:08	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.300	mg/L	0.010	--	08/24/2006	14:16	DMALDONADO	--	--	N/A

To:	INSTITUTO DE RECURSOS DE AGUA P.O. BOX 51124 TOA BAJA PR 00950
Attn:	ENG. LUIS CAMPOS
Source:	**268**
Project Name:	INTERNAL DATA
Facility:	SAN JOSE LAGOON
Description:	SURFACE WATER - Grab
Client Ref. #:	N/A
PWSID:	
Permit No.:	

eqlab ENVIRONMENTAL QUALITY LABORATORIES, INC.

Laboratory Test Report

Page 1 of 1

Sample Number:	**882048**	Collected Date & Time:	**08/14/2006**	14:50	Date of Report:	8/25/06
Work Order:	1511-00-02	Received Date & Time:	08/14/2006	18:30	Collected By:	LCAMPOS
Delivery Slip:	2006-08315	Temperature at Arrival:	3 °C		Eqlab Rep.:	ELEVY
Folder Number:	82717				Proposal Number:	6779 - 1

Remarks:

Parameter	Method	Results	Units	Limits		Analysis			Prep Method		
				MDL	MCL	Date	Time	By	Date	By	Method
Nitrate as N	EPA 353.2	BDL	mg/L	0.01	--	08/15/2006	16:00	LHERNANDEZ	--	--	N/A
Total Phosphorus	EPA 365.3	0.021	mg/L	0.010	--	08/24/2006	14:16	DMALDONADO	--	--	N/A

SONIA PICHARDO RODRIGUEZ
Químico Licenciado
Estado Libre Asociado de Puerto Rico
LICENCIA NUM.

nelac

ENVIRONMENTAL QUALITY LABORATORIES, INC.

SAMPLE DELIVERY SLIP & CHAIN OF CUSTODY

PO BOX 11458, SAN JUAN, PR 00910-1458 • TEL. (787) 725-5333, FAX (787) 722-0380, e-mail: eqlab@coqui.net

CLIENT NAME:	CLIENT ID:	W.O. #:	SITE NAME: SAN JOSE LAGOON	CLIENT REP:
P.O. #:	PWSID #:	FOLDER #:	PROJECT: SAN JOSE LAGOON	EQLAB REP:

SAMPLE INFORMATION		CONTAINER INFORMATION	FIELD TESTING	ANALYSIS REQUESTED
SAMPLE #: 266 MATRIX: SURFACE WATER SOURCE: SAMPLE #8	DATE: 8/14/06 TIME: 2:40 PM TYPE: Grab	TYPE: P/PC COLOR: N/A VOLUME: 200 PRESERVATIVE: Cool 4 °C		Nitrate, Nitrite
SAMPLE #: 266 MATRIX: SURFACE WATER SOURCE: SAMPLE #8	DATE: 8/14/06 TIME: 2:40 PM TYPE: Grab	TYPE: P/PC COLOR: N/A VOLUME: 100 PRESERVATIVE: H2SO4 pH<2, Cool 4 °C		Nitrate + Nitrite, Total Phosphorus
SAMPLE #: 267 MATRIX: SURFACE WATER SOURCE: SAMPLE #10	DATE: 8/14/06 TIME: 2:45 PM TYPE: Grab	TYPE: P/PC COLOR: N/A VOLUME: 100 PRESERVATIVE: Cool 4 °C		Nitrate, Nitrite
SAMPLE #: 267 MATRIX: SURFACE WATER SOURCE: SAMPLE #10	DATE: 8/14/06 TIME: 2:45 PM TYPE: Grab	TYPE: P/PC COLOR: N/A VOLUME: 100 PRESERVATIVE: H2SO4 pH<2, Cool 4 °C		Nitrate + Nitrite, Total Phosphorus
SAMPLE #: 268 MATRIX: SURFACE WATER SOURCE: SAMPLE #11	DATE: 8/14/06 TIME: 2:50 PM TYPE: Grab	TYPE: P/PC COLOR: N/A VOLUME: 100 PRESERVATIVE: Cool 4 °C		Nitrate, Nitrite
SAMPLE #: 268 MATRIX: SURFACE WATER SOURCE: SAMPLE #11	DATE: 8/14/06 TIME: 2:50 PM TYPE: Grab	TYPE: P/PC COLOR: N/A VOLUME: 100 PRESERVATIVE: H2SO4 pH<2, Cool 4 °C		Nitrate + Nitrite, Total Phosphorus

CUSTODY RECORD	SIGNATURE	DATE	TIME
Collected in field by:		8/14/06	6:30 PM
Fixed in field by:		8/14/06	6:30 PM
Released to EQLF by:			
Received by EQLF:			
Released to EQLL by:		8/14/06	6:30 PM
Received by EQLL:		8/14/06	1830

SPECIAL INSTRUCTIONS / COMMENTS:

*EQLF = Eqlabs' Field Personnel.
*EQLL = Eqlabs' Log-in Personnel.

Arrival Temperature: __________ Signature: __________

Eqlabs' general terms and conditions on reverse side of this document.

APPENDIX C

FIELD RADIANCES FOR FEBRUARY, MAY, AND AUGUST 2006

STATION 266

APPENDIX C-1A

TOTAL SKY RADIANCE CALCULATION

FEBRUARY 24, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0.01	0.01	0.01	0.01
115.33	0.03	0.04	0.04	0.0366667
122.58	0.04	0.04	0.04	0.04
129.71	0.04	0.04	0.04	0.04
136.72	0.05	0.05	0.05	0.05
143.6	0.05	0.05	0.05	0.05
150.37	0.05	0.05	0.05	0.05
157.02	0.05	0.05	0.05	0.05
163.55	0.06	0.06	0.06	0.06
169.97	0.06	0.06	0.06	0.06
176.28	0.06	0.06	0.06	0.06
182.48	0.06	0.07	0.07	0.0666667
188.57	0.06	0.07	0.07	0.0666667
194.55	0.07	0.07	0.07	0.07
200.43	0.07	0.07	0.07	0.07
206.21	0.07	0.08	0.08	0.0766667
211.88	0.08	0.08	0.08	0.08
217.46	0.08	0.08	0.08	0.08
222.94	0.08	0.09	0.09	0.0866667
228.33	0.08	0.09	0.09	0.0866667
233.62	0.09	0.09	0.09	0.09
238.82	0.09	0.1	0.09	0.0933333
243.92	0.1	0.1	0.1	0.1
248.94	0.1	0.11	0.11	0.1066667
253.87	0.14	0.15	0.15	0.1466667
258.72	0.2	0.2	0.2	0.2
263.48	0.32	0.33	0.33	0.3266667
268.16	0.5	0.49	0.51	0.5
272.75	0.68	0.75	0.74	0.7233333
277.27	1	1.01	1.04	1.0166667
281.71	1.99	2.02	2.04	2.0166667
286.07	4.23	4.5	4.45	4.3933333
290.36	6.83	7.17	7.03	7.01
294.57	10.41	10.53	10.94	10.626667
298.71	14.45	14.98	15.05	14.826667
302.78	36.41	36.83	37.08	36.773333
306.78	71.51	73.42	75.47	73.466667
310.71	119.9	123.66	125.95	123.17
314.57	190.78	196.09	196.93	194.6
318.37	286.69	292.22	296.71	291.87333
322.1	525.28	533.02	537.14	531.81333
325.77	958.01	974.03	983.18	971.74
329.38	1532.3	1558.82	1574.53	1555.2167
332.93	2763.08	2808.02	2852.96	2808.02
336.42	4348.15	4392.35	4463.44	4401.3133
339.85	5927.74	6039.84	6119.91	6029.1633
343.22	7396.91	7512.49	7600.43	7503.2767
346.53	8928.67	9090.13	9208.53	9075.7767
349.79	10461.09	10632.31	10755.81	10616.403
353	12068.99	12258.26	12394.3	12240.517
356.16	13094.12	13288.2	13467.11	13283.143
359.26	14048.22	14291.38	14479.15	14272.917
362.32	15328.18	15582.62	15775	15561.933
365.32	17085.47	17365.36	17561.28	17337.37
368.28	18889.22	19137.03	19391.04	19139.097
371.19	20687.18	20991.5	21233.07	20970.583
374.05	22422.27	22759.86	23039.57	22740.567
376.87	23809.07	24164.33	24457.09	24143.497
379.64	25189.42	25594.14	25928.61	25570.723
382.37	28023.32	28390.98	28775.65	28396.65
385.06	32189.71	32680.29	33095.4	32655.133
387.71	36874.25	37450.35	37937.3	37420.633
390.32	41203.48	41838.69	42378.79	41806.987
392.89	44651.6	45345.61	45920.55	45305.92
395.42	46340.69	47086.54	47683.21	47036.813
397.92	47343.62	48117.21	48712.53	48057.787
400.37	48325.23	49090.39	49698.51	49038.043
402.8	49915.67	50715.12	51370.14	50666.977
405.18	51469.35	52298.63	52972.84	52246.94
407.54	52807.79	53674	54323.65	53601.813
409.86	53784.33	54658.71	55316.19	54586.41
412.15	54536.84	55405.75	56117.91	55353.5
414.4	54783.25	55684.92	56391.91	55620.027
416.63	54750.91	55607.62	56344.87	55567.8
418.83	54771.59	55661.05	56339.22	55590.62
420.99	54484.53	55405.41	56109.62	55333.187
423.13	54180.76	55030.44	55792.46	55001.22
425.25	53631.77	54494.74	55189.82	54438.777
427.33	52760.4	53612.66	54325.1	53566.053
429.39	51465.41	52295.98	53007.89	52256.427
431.43	50413.66	51254.82	51866.86	51178.447
433.44	51048.02	51845.85	52575.57	51823.147
435.42	53225.73	54115.4	54802.72	54047.95
437.38	55256.09	56233.43	56943.35	56144.29
439.32	56206.47	57132.89	57867.1	57068.82
441.24	56413.33	57344.21	58093.29	57283.61
443.14	56580.42	57488.16	58283.21	57450.597
445.02	57511.8	58485.25	59270.9	58422.65
446.87	58731.81	59749.88	60529.88	59670.523
448.71	59128.5	60137.55	60964.28	60076.777
450.53	59157.67	60111.31	60932.77	60067.25
452.33	59660.79	60624.28	61455.53	60580.2
454.11	60479.11	61450.47	62214.36	61381.313
455.88	60723.89	61748.13	62572.52	61681.513
457.63	59909.42	60930.26	61766.6	60868.76
459.36	59108.64	60099.53	60888	60032.057
461.08	58915.46	59867.91	60713.87	59832.413
462.78	58815.33	59800.49	60586.32	59734.047

464.47	58179.29	59127.07	59967.33	59091.23	542.3	27753	28246.55	28659.43	28219.66
466.15	57607.68	58653.37	59417.42	58559.49	543.74	27556.77	28058.65	28490.5	28035.307
467.81	57220.52	58184.06	58930.12	58111.567	545.18	27310.49	27772.6	28200.4	27761.163
469.46	56189.73	57148.83	57954.47	57097.677	546.62	26954.2	27466.33	27863.91	27428.147
471.1	54874.61	55857.21	56598.28	55776.7	548.07	26667.54	27141.17	27562.16	27123.623
472.72	53780.85	54709.82	55465.12	54651.93	549.51	26349.71	26854.45	27241.06	26815.073
474.33	52994.9	53930.15	54600.98	53842.01	550.96	25997.04	26469.34	26872.05	26446.143
475.94	52287	53178.99	53927.47	53131.153	552.41	25651.29	26139	26543.69	26111.327
477.53	51916.73	52800.51	53520.01	52745.75	553.86	25233.67	25696.97	26104.92	25678.52
479.11	51618.56	52504.46	53196.65	52439.89	555.32	24695.13	25155.73	25542.96	25131.273
480.68	51066.95	51950.75	52618.57	51878.757	556.77	24208.96	24652.9	25037.79	24633.217
482.24	50378.58	51242.26	51956.35	51192.397	558.23	23911.49	24358.89	24724.2	24331.527
483.8	49820.57	50651.05	51375.99	50615.87	559.69	23684	24111.36	24482.43	24092.597
485.34	49268.94	50109.5	50792.28	50056.907	561.16	23394.34	23832.45	24179.11	23801.967
486.88	48534.74	49393.05	50068.58	49332.123	562.62	23001.06	23447.94	23788.52	23412.507
488.41	47336.79	48172.05	48834.59	48114.477	564.09	22686.53	23098.81	23439.77	23075.037
489.93	45367.05	46164.82	46797	46109.623	565.56	22330.97	22738.39	23086.64	22718.667
491.45	43419.13	44156.38	44792.87	44122.793	567.03	21958.49	22367.11	22715.36	22346.987
492.95	43112.54	43870.46	44471.49	43818.163	568.51	21735.02	22157.58	22497.52	22130.04
494.46	43595.38	44355.18	44964.45	44305.003	569.99	21611.46	22025.37	22353.14	21996.657
495.95	43182.27	43944.08	44588.88	43905.077	571.47	21418.38	21803.34	22149.8	21790.507
497.44	42503.51	43223.71	43852.68	43193.3	572.95	21153.86	21557.27	21893.04	21534.723
498.93	42063.02	42819.69	43411.44	42764.717	574.44	20977.65	21346.66	21691.54	21338.617
500.41	41542.4	42296.19	42870.16	42236.25	575.93	20818.38	21192.4	21528.07	21179.617
501.88	40640.11	41373.6	41964.4	41326.037	577.42	20695.58	21066.55	21399.47	21053.867
503.35	39594.52	40341.87	40880.78	40272.39	578.92	20486.19	20841.02	21162.96	20830.057
504.82	38605.23	39246.33	39838.52	39230.027	580.42	20142.87	20524.06	20845.18	20504.037
506.28	37984.04	38614.95	39206.91	38601.967	581.92	19698.16	20059.2	20395.26	20050.873
507.74	37652.91	38299.72	38881.59	38278.073	583.42	19081.74	19432.83	19761.55	19425.373
509.2	37522.65	38196.68	38722.94	38147.423	584.93	18518.44	18899.34	19174.55	18864.11
510.65	36962.57	37638.39	38206.69	37602.55	586.44	18320.17	18632.89	18956.47	18636.51
512.1	36351.18	37009.83	37542.78	36967.93	587.95	18300.92	18632.26	18948.53	18627.237
513.55	35802.7	36447.04	36975.8	36408.513	589.47	18204.17	18530.77	18833.88	18522.94
514.99	35125.07	35766.89	36284.17	35725.377	590.99	18098.65	18421.95	18721.86	18414.153
516.44	34252.93	34848.92	35342.47	34814.773	592.51	17995.12	18320.37	18630.74	18315.41
517.88	33286.58	33889.64	34352.15	33842.79	594.03	17881.77	18198.26	18482.67	18187.567
519.32	32169.35	32760.04	33231.26	32720.217	595.56	17731.7	18041.88	18358.51	18044.03
520.76	31783.53	32345.51	32833.72	32320.92	597.09	17618.64	17958.89	18218.44	17931.99
522.2	32072.65	32635.26	33107.67	32605.193	598.62	17495.5	17846.61	18137.72	17826.61
523.63	32149.45	32744.57	33213.39	32702.47	600.16	17386.75	17705.88	17979.74	17690.79
525.07	31987.99	32579.92	33038.89	32535.6	601.7	17180.76	17487.73	17783.15	17483.88
526.5	31613.86	32164.83	32665.92	32148.203	603.24	16918.28	17262.74	17539.24	17240.087
527.94	30984.38	31550.05	32014.47	31516.3	604.79	16671.09	17006.13	17260.37	16979.197
529.37	30837.48	31366.46	31857.33	31353.757	606.34	16457.75	16756.28	17059.63	16757.887
530.81	30841.45	31416.64	31834.34	31364.143	607.89	16236.77	16557.24	16838.86	16544.29
532.24	30572.73	31131.98	31563.08	31089.263	609.44	16033.81	16328.09	16600.31	16320.737
533.67	30079.57	30603.49	31053.93	30578.997	611	15849.44	16170.43	16446.98	16155.617
535.11	29753.89	30297.54	30749.78	30267.07	612.56	15751.3	16049.29	16327.41	16042.667
536.55	29431.05	29975.04	30402.45	29936.18	614.12	15655.4	15969.16	16228.13	15950.897
537.98	29002.77	29516.16	29963.85	29494.26	615.69	15463.22	15767.49	16024.38	15751.697
539.42	28401.54	28910.44	29356.33	28889.437	617.25	15237.81	15528.74	15779.88	15515.477
540.86	27999.49	28499.18	28919.59	28472.753	618.82	14968.84	15250.81	15510.51	15243.387

620.4	14761.8	15056.3	15291.9	15036.667	704.45	8887.17	9048.81	9222.42	9052.8
621.97	14570.17	14835.39	15078.72	14828.093	706.08	8849.12	9023.99	9186.8	9019.97
623.55	14388.32	14657.89	14925.05	14657.087	707.71	8808.94	8948.38	9148.44	8968.5867
625.13	14256.45	14519.31	14789.34	14521.7	709.34	8665.68	8854.66	9000.97	8840.4367
626.71	14186.48	14466.47	14691.87	14448.273	710.97	8403.22	8602.63	8762.17	8589.34
628.3	14131.89	14380.07	14618.79	14376.917	712.6	7919.27	8070.44	8218.52	8069.41
629.89	13996.55	14277.47	14522.98	14265.667	714.23	7145.92	7312.9	7427.31	7295.3767
631.47	13865.12	14153.38	14386.85	14135.117	715.86	6627.96	6718.11	6842.46	6729.51
633.07	13772.05	14033.23	14287.14	14030.807	717.49	6562.3	6711.59	6857.76	6710.55
634.66	13659.59	13907.37	14150.24	13905.733	719.11	6857.15	6972.47	7112.73	6980.7833
636.26	13513.38	13765.64	13998.12	13759.047	720.74	6856.2	6968.34	7133.44	6985.9933
637.86	13350.98	13605.14	13829.41	13595.177	722.36	6665.1	6796.22	6942.95	6801.4233
639.46	13116.85	13396.04	13619.89	13377.593	723.99	6575.68	6694.27	6850.31	6706.7533
641.06	12870.76	13114.86	13346.24	13110.62	725.61	6571.35	6727.89	6853.12	6717.4533
642.66	12625.15	12868.24	13098.53	12863.973	727.23	6626.46	6789.69	6886.99	6767.7133
644.27	12482.78	12722.68	12931.63	12712.363	728.85	6821.56	7010.79	7130.63	6987.66
645.88	12339.52	12589.49	12803.01	12577.34	730.47	7168.28	7285.43	7475.4	7309.7033
647.49	12192.03	12420.48	12646.31	12419.607	732.08	7434.46	7580.92	7711.46	7575.6133
649.1	11900.8	12122.7	12347.24	12123.58	733.7	7570.76	7679.74	7823.98	7691.4933
650.71	11656.98	11868.59	12098.94	11874.837	735.32	7594.6	7742.94	7907.41	7748.3167
652.32	11650.65	11859.72	12082.36	11864.243	736.93	7652.93	7769.86	7919.28	7780.69
653.94	11797.05	12026.25	12241.64	12021.647	738.54	7690.47	7834.71	7959.27	7828.15
655.56	11870.3	12096.85	12306.63	12091.26	740.15	7748	7913.27	8055.41	7905.56
657.18	11863.7	12053.67	12294.69	12070.687	741.76	7785.44	7955.41	8075.39	7938.7467
658.8	11758.81	12001.76	12196.12	11985.563	743.37	7835.7	8027.64	8145.5	8002.9467
660.42	11662.93	11884.51	12103.2	11883.547	744.97	7794.12	7960.74	8120.57	7958.4767
662.04	11559.49	11766.68	11979.63	11768.6	746.58	7746.82	7915.15	8083.49	7915.1533
663.66	11443.83	11671.96	11865.88	11660.557	748.18	7672.81	7860.46	7995.98	7843.0833
665.29	11335.39	11570.43	11751.66	11552.493	749.78	7633.42	7791.35	7928.23	7784.3333
666.92	11215.27	11443.87	11624.49	11427.877	751.38	7582.77	7710.33	7898.13	7730.41
668.54	11137.98	11361.65	11605.13	11368.253	752.98	7519.37	7688.06	7824.45	7677.2933
670.17	11042.91	11270.66	11467.09	11260.22	754.57	7384.47	7529.48	7703.48	7539.1433
671.8	10976.62	11179.26	11381.89	11179.257	756.16	6966.24	7061.41	7229.8	7085.8167
673.43	10893.35	11093.86	11254.26	11080.49	757.76	5846.54	5939.16	6072.54	5952.7467
675.06	10767.65	10979.79	11160.4	10969.28	759.35	4429	4526.59	4631.69	4529.0933
676.69	10623.94	10848.21	11035.1	10835.75	760.93	3747.69	3789.29	3902.74	3813.24
678.32	10405.61	10630.07	10822.87	10619.517	762.52	3904.87	3992.66	4053.74	3983.7567
679.95	10060.9	10251.21	10453.07	10255.06	764.1	4507.75	4611.42	4741.97	4620.38
681.58	9502.42	9658.52	9834.87	9665.27	765.69	5314.54	5460.98	5553.48	5443
683.22	8907.84	9093.3	9241.08	9080.74	767.27	6084.38	6216.14	6344.03	6214.85
684.85	8754.83	8902.82	9105.95	8921.2	768.85	6523.33	6675.12	6795.78	6664.7433
686.48	8883.85	9035.36	9218.92	9046.0433	770.42	6745.4	6889.83	7045.98	6893.7367
688.12	8970.4	9104.81	9294.74	9123.3167	772	6830.48	6948.11	7101.03	6959.8733
689.75	8934.95	9122.31	9265.76	9107.6733	773.57	6795.86	6957.29	7118.72	6957.29
691.38	9004.58	9160.28	9321.87	9162.2433	775.14	6823.65	6945.93	7103.7	6957.76
693.02	9052.73	9261.96	9391.62	9235.4367	776.7	6773.95	6924.48	7023.52	6907.3167
694.65	9021.28	9195.33	9354.64	9190.4167	778.27	6710.16	6841.19	7035.74	6862.3633
696.29	8854.72	9026.43	9212.94	9031.3633	779.83	6687.81	6851.12	6954.68	6831.2033
697.92	8781.85	8971.47	9110.72	8954.68	781.4	6622.19	6801.7	6961.27	6795.0533
699.55	8813.66	8959.21	9134.48	8969.1167	782.96	6577.91	6746.16	6866.34	6730.1367
701.19	8857.46	9026.88	9169.55	9017.9633	784.51	6522.47	6630.91	6819.68	6657.6867
702.82	8880.93	9066.26	9221.69	9056.2933	786.07	6392.87	6517.74	6727.21	6545.94

787.62	6276.75	6434.47	6555.8	6422.34	865.69	4325.92	4424.39	4555.68	4435.33
789.17	6154.48	6264.23	6463.42	6294.0433	867.15	4384.15	4521.57	4639.35	4515.0233
790.72	6044.67	6179.54	6371.63	6198.6133	868.62	4423.99	4547.61	4671.22	4547.6067
792.27	6009.67	6128.96	6272.92	6137.1833	870.08	4436.38	4533.67	4650.42	4540.1567
793.81	5987.6	6107.68	6269.17	6121.4833	871.54	4452.57	4504.19	4665.52	4540.76
795.35	5948.17	6073.39	6223.66	6081.74	873	4370.86	4519.35	4596.83	4495.68
796.89	5923.48	6003.3	6137.74	6021.5067	874.46	4312.95	4467.68	4577.27	4452.6333
798.43	5866.24	6015.02	6117.04	5999.4333	875.91	4305	4479.52	4595.87	4460.13
799.97	5788.43	5891.26	6066.93	5915.54	877.37	4305.76	4428.78	4532.38	4422.3067
801.5	5721.39	5881.52	5985.39	5862.7667	878.83	4278.94	4409	4552.06	4413.3333
803.03	5681.56	5808.4	5992.1	5827.3533	880.29	4262.56	4360.78	4485.19	4369.51
804.56	5664.82	5784.22	5912.47	5787.17	881.74	4208.22	4287.37	4472.06	4322.55
806.09	5658.75	5774.87	5989.25	5807.6233	883.2	4179.83	4273.01	4426.09	4292.9767
807.61	5629.02	5733.18	5869.03	5743.7433	884.66	4158.04	4258.97	4406.99	4274.6667
809.14	5445.07	5586.8	5737.67	5589.8467	886.11	4094.87	4237.72	4326.14	4219.5767
810.66	5280.73	5428.96	5540.13	5416.6067	887.57	4114.38	4183.3	4348.7	4215.46
812.17	5021.21	5128.65	5222.06	5123.9733	889.03	4101.85	4150.77	4304.5	4185.7067
813.69	4615.93	4691.6	4828.75	4712.0933	890.48	3925.82	4025.21	4152.99	4034.6733
815.21	4266.93	4410.44	4486.98	4388.1167	891.94	3701.4	3809.63	3867.35	3792.7933
816.72	4111.48	4193.61	4348.21	4217.7667	893.39	3447	3528.02	3542.75	3505.9233
818.23	4127.65	4225.35	4332.81	4228.6033	894.85	3094.32	3161.75	3319.09	3191.72
819.74	4290.2	4329.7	4487.68	4369.1933	896.31	2852.79	2921.62	3059.29	2944.5667
821.25	4278.54	4363.41	4428.31	4356.7533	897.76	2767.65	2752.01	2947.47	2822.3767
822.75	4189.75	4300.67	4426.72	4305.7133	899.22	2813.51	2845.48	2941.4	2866.7967
824.25	4288.48	4395.57	4507.75	4397.2667	900.68	2848.17	2929.78	2986.91	2921.62
825.75	4417.12	4571.74	4633.59	4540.8167	902.14	3003.73	3128.89	3237.36	3123.3267
827.25	4418.89	4538.61	4684.34	4547.28	903.59	3034.97	3137.56	3197.4	3123.31
828.75	4352.17	4447.12	4542.08	4447.1233	905.05	2900.77	2900.77	3023.09	2941.5433
830.25	4339.56	4467.51	4616.78	4474.6167	906.51	2751.68	2805.46	2930.95	2829.3633
831.74	4389.61	4459.63	4642.75	4497.33	907.97	2628.07	2701.58	2756.72	2695.4567
833.23	4428.41	4537.48	4641.1	4535.6633	909.43	2622.1	2678.49	2800.67	2700.42
834.72	4579.95	4679.27	4822.74	4693.9867	910.89	2550.49	2608.24	2714.1	2624.2767
836.21	4653.04	4797.92	4848.08	4766.3467	912.35	2477.92	2527.28	2616.13	2540.4433
837.7	4733.89	4852.38	4987.79	4858.02	913.82	2425.9	2577.52	2557.3	2520.24
839.18	4792.96	4924.19	5015.49	4910.88	915.28	2560.17	2663.82	2694.91	2639.6333
840.67	4837.59	4964.44	5097.05	4966.36	916.74	2688.93	2688.93	2848.35	2742.07
842.15	4828.03	4927.28	5049.88	4935.0633	918.21	2774.03	2871.93	2980.72	2875.56
843.63	4843.96	4944.38	5103.88	4964.0733	919.68	2821.91	2799.6	2944.6	2855.37
845.11	4864.14	4989.32	5060.85	4971.4367	921.14	2800.87	2835.17	2823.74	2819.9267
846.59	4847.07	4985.9	5064.37	4965.78	922.61	2655.82	2796.21	2854.71	2768.9133
848.07	4763.83	4892.25	4990.1	4882.06	924.08	2682.11	2658.17	2741.98	2694.0867
849.54	4669.88	4750.39	4880.46	4766.91	925.55	2310.38	2470.14	2593.03	2457.85
851.02	4628.96	4691.68	4879.85	4733.4967	927.02	2015.72	1990.52	2166.9	2057.7133
852.49	4489.28	4603.9	4686.68	4593.2867	928.49	1642.77	1668.64	1707.44	1672.95
853.96	4435.34	4551.04	4615.32	4533.9	929.97	1317.78	1264.53	1331.09	1304.4667
855.43	4467.01	4532.03	4688.09	4562.3767	931.44	1123.54	1055.03	1192.05	1123.54
856.9	4578.34	4696.4	4834.15	4702.9633	932.92	1067.59	1109.74	1194.02	1123.7833
858.37	4597.62	4696.56	4815.29	4703.1567	934.4	1077.69	1092.06	1120.8	1096.85
859.83	4634.52	4694.03	4813.03	4713.86	935.88	1140.39	1228.11	1096.53	1155.01
861.3	4601.45	4700.76	4839.8	4714.0033	937.36	1291.96	1351.36	1470.17	1371.1633
862.76	4533.08	4658.63	4764.36	4652.0233	938.84	1342.75	1403.1	1388.02	1377.9567
864.23	4388.06	4559.63	4698.2	4548.63	940.32	1112.12	1251.14	1405.6	1256.2867

941.81	1197.83	1197.83	1292.4	1229.3533	1020.8	2982.35	3036.57	3524.59	3181.17
943.29	1238.82	1303.18	1335.35	1292.45	1022.33	3398.39	3511.67	3511.67	3473.91
944.78	1195.27	1277.14	1293.51	1255.3067	1023.86	3652.88	3476.13	2945.87	3358.2933
946.27	1283.7	1283.7	1417.08	1328.16	1025.39	3206.61	3329.94	3761.6	3432.7167
947.76	1372.23	1321.4	1406.11	1366.58	1026.91	3400.7	3400.7	3721.52	3507.64
949.25	1276.53	1276.53	1311.03	1288.03	1028.44	3214.56	3683.35	3482.44	3460.1167
950.74	1297.3	1367.42	1349.89	1338.2033	1029.96	3434.27	3504.36	3714.62	3551.0833
952.24	1423.72	1352.53	1405.92	1394.0567	1031.48	3148.63	3221.85	3295.08	3221.8533
953.74	1446.14	1391.91	1337.68	1391.91	1033	3444.08	3673.69	3137.94	3418.57
955.23	1396.87	1507.15	1507.15	1470.39	1034.51	3751.94	3751.94	4071.25	3858.3767
956.73	1507.97	1414.89	1489.35	1470.7367	1036.02	3423.3	4007.76	3256.31	3562.4567
958.24	1493.18	1549.88	1587.68	1543.58	1037.53	3571.86	4355.92	3833.21	3920.33
959.74	1649.67	1688.03	1745.58	1694.4267	1039.03	3737.67	3373.02	4011.16	3707.2833
961.24	1789.8	1809.25	1692.52	1763.8567	1040.54	3728.56	3824.16	4206.58	3919.7667
962.75	1854.98	1795.78	2052.32	1901.0267	1042.03	4081.8	3584.02	4081.8	3915.8733
964.26	2065.66	2065.66	2005.49	2045.6033	1043.53	3855.23	3438.45	3438.45	3577.3767
965.77	2192.43	2090.92	2395.43	2226.26	1045.02	2947.57	3493.41	3930.09	3457.0233
967.28	2352.45	2435	2455.63	2414.36	1046.5	3869.97	3300.86	3756.15	3642.3267
968.79	2490.32	2427.54	2490.32	2469.3933	1047.98	3918.68	3918.68	4274.92	4037.4267
970.3	2169.9	2510.28	2574.1	2418.0933	1049.46	4344.36	3599.61	4716.73	4220.2333
971.82	2448.04	2318.06	2469.7	2411.9333	1050.93	4920.2	2978.02	2460.1	3452.7733
973.34	2360.86	2250.54	2537.37	2382.9233	1052.39	3778.16	3913.09	4048.03	3913.0933
974.85	2309.39	2331.81	2511.18	2384.1267	1053.85	4535.11	5527.16	3826.5	4629.59
976.37	2485.31	2508.11	2416.91	2470.11	1055.3	3542.58	3985.41	4871.05	4133.0133
977.9	2301.2	2487.15	2789.33	2525.8933	1056.75	3371.75	3218.49	4751.11	3780.45
979.42	2512.14	2606.94	2796.53	2638.5367	1058.19	4500.5	3857.57	4661.23	4339.7667
980.94	2703.05	2775.45	2847.85	2775.45	1059.62	3991.14	4157.44	4490.03	4212.87
982.47	2657.84	2805.5	2805.5	2756.28	1061.05	4020.79	3671.16	5244.51	4312.1533
983.99	2888.48	3089.41	2938.71	2972.2	1062.46	3656.75	4205.26	5850.79	4570.9333
985.52	2847.49	2975.76	3257.94	3027.0633	1063.87	4008.15	4771.6	4962.47	4580.74
987.05	2782.31	2992.3	3176.04	2983.55	1065.27	4969.94	4771.14	5765.13	5168.7367
988.58	3117.12	3090.25	3412.71	3206.6933	1066.67	4484.3	4484.3	4076.64	4348.4133
990.11	3271.79	3161.81	3079.33	3170.9767	1068.05	5216.82	3338.76	6886.2	5147.26
991.64	2826.88	3222.64	3335.72	3128.4133	1069.42	4702.65	3633.87	5985.2	4773.9067
993.17	3128.29	3128.29	3360.01	3205.53	1070.79	4547.93	6063.91	4331.36	4981.0667
994.71	3213.34	3272.85	3213.34	3233.1767	1072.14	3713.38	3494.94	5897.72	4368.68
996.24	3026.94	2874.07	3546.72	3149.2433	1073.48	5067.73	4627.06	4627.06	4773.95
997.77	3026.58	3247.27	3089.63	3121.16	1074.82	4634.74	4634.74	4414.03	4561.17
999.31	3140.38	3205.13	3172.76	3172.7567	1076.14	5539.88	4653.5	5096.69	5096.69
1000.85	2814.38	3115.92	3551.48	3160.5933	1077.44	4227.49	4449.99	4004.99	4227.49
1002.38	3253.97	3184.74	3219.35	3219.3533	1078.74	4736.99	5639.28	4962.56	5112.9433
1003.92	2999.81	3214.08	3285.5	3166.4633	1080.02	4597.27	5746.59	6206.32	5516.7267
1005.45	3256.62	3219.62	3071.59	3182.61	1081.3	6764.18	4431.7	5597.94	5597.94
1006.99	3217.85	3064.61	3332.77	3205.0767	1082.55	4746.77	3560.08	6882.81	5063.22
1008.53	3093	3330.92	3410.23	3278.05	1083.79	4920.8	7873.28	6397.04	6397.04
1010.06	3090.3	3131.5	3502.34	3241.38	1085.02	5276.86	5276.86	5528.14	5360.62
1011.6	3338.18	3509.37	3209.79	3352.4467	1086.24	6472.24	5436.68	6731.13	6213.35
1013.13	2842.62	3686.53	3553.28	3360.81	1087.43	5087.22	4819.47	4283.97	4730.22
1014.67	3417.69	3602.43	3417.69	3479.27	1088.62	2487.75	7463.26	4422.68	4791.23
1016.2	3166.76	3310.7	3262.72	3246.7267	1089.78	7473.35	3736.67	5461.29	5557.1033
1017.74	3251.81	3351.87	3401.89	3335.19					
1019.27	3225.89	2913.71	3694.17	3277.9233					

APPENDIX C-1B

TOTAL WATER RADIANCE CALCULATION

FEBRAUARY 24, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0	0	0	0
115.33	0.02	0.02	0.01	0.0166667
122.58	0.03	0.02	0.01	0.02
129.71	0.03	0.02	0.01	0.02
136.72	0.03	0.02	0.01	0.02
143.6	0.03	0.03	0.01	0.0233333
150.37	0.03	0.02	0.01	0.02
157.02	0.03	0.03	0.02	0.0266667
163.55	0.04	0.03	0.02	0.03
169.97	0.04	0.03	0.02	0.03
176.28	0.04	0.03	0.02	0.03
182.48	0.04	0.03	0.02	0.03
188.57	0.04	0.03	0.02	0.03
194.55	0.05	0.03	0.02	0.0333333
200.43	0.05	0.04	0.02	0.0366667
206.21	0.05	0.04	0.02	0.0366667
211.88	0.05	0.04	0.02	0.0366667
217.46	0.05	0.04	0.02	0.0366667
222.94	0.06	0.04	0.02	0.04
228.33	0.06	0.04	0.02	0.04
233.62	0.06	0.05	0.03	0.0466667
238.82	0.06	0.05	0.03	0.0466667
243.92	0.06	0.05	0.03	0.0466667
248.94	0.06	0.05	0.03	0.0466667
253.87	0.09	0.07	0.04	0.0666667
258.72	0.12	0.09	0.05	0.0866667
263.48	0.2	0.16	0.09	0.15
268.16	0.29	0.23	0.13	0.2166667
272.75	0.43	0.33	0.2	0.32
277.27	0.58	0.46	0.25	0.43
281.71	1.16	0.92	0.49	0.8566667
286.07	2.35	1.84	1.08	1.7566667
290.36	3.58	2.95	1.66	2.73
294.57	5.1	4.15	2.37	3.8733333
298.71	6.92	5.68	3.28	5.2933333
302.78	15.64	12.91	7.27	11.94
306.78	28.78	24.15	13.36	22.096667
310.71	42.44	37.54	20.85	33.61
314.57	63.97	54.89	30.73	49.863333
318.37	85.94	74.52	44.27	68.243333
322.1	145.51	127.97	71.72	115.06667
325.77	251.33	215.86	123.18	196.79
329.38	387	332	188.59	302.53
332.93	679.9	568.27	326.18	524.78333
336.42	1030.84	866.56	493.8	797.06667
339.85	1415.02	1177.08	668.04	1086.7133
343.22	1767.57	1459.78	821.6	1349.65
346.53	2139.33	1751.83	991.63	1627.5967
349.79	2517.74	2040.57	1142.38	1900.23
353	2954.4	2364.41	1310.11	2209.64
356.16	3221.98	2615.49	1440.41	2425.96
359.26	3453.57	2841.04	1554.42	2616.3433
362.32	3756.03	3110.63	1703.48	2856.7133
365.32	4218.5	3487.69	1912.55	3206.2467
368.28	4759.48	3895.24	2131.16	3595.2933
371.19	5327.09	4255.71	2327.86	3970.22
374.05	5922.26	4644.25	2530.3	4365.6033
376.87	6439.11	5024.64	2708.87	4724.2067
379.64	6749.73	5406.81	2904.93	5020.49
382.37	7404.12	6115.63	3283.34	5601.03
385.06	8616.06	7164.9	3804.58	6528.5133
387.71	9965.27	8223.23	4406.53	7531.6767
390.32	11537.32	9285.22	4913.51	8578.6833
392.89	12820.54	10144.84	5341.18	9435.52
395.42	13552.34	10689.31	5602.31	9947.9867
397.92	14065.86	11067.36	5801.91	10311.71
400.37	14556.38	11469.01	5974.25	10666.547
402.8	15290.45	12038.88	6241.14	11190.157
405.18	16029.39	12606.08	6506.15	11713.873
407.54	16679.44	13109.75	6745.2	12178.13
409.86	17341.8	13552.84	6954.34	12616.327
412.15	17821.16	13926.4	7131.87	12959.81
414.4	18205.87	14209.83	7250.93	13222.21
416.63	18431.2	14437.78	7345.18	13404.72
418.83	18682.05	14669.26	7449.65	13600.32
420.99	18898.44	14806.94	7499.11	13734.83
423.13	19122.92	14950.37	7530.82	13868.037
425.25	19222.08	15006.28	7573.66	13934.007
427.33	19265.8	15021.13	7570.49	13952.473
429.39	19061.81	14848.01	7506.4	13805.407
431.43	18842.53	14797.13	7465.66	13701.773
433.44	19267.87	15387.38	7741.53	14132.26
435.42	20553.83	16240.4	8169.18	14987.803
437.38	21725.83	17147.95	8546.12	15806.633
439.32	22440.68	17636.8	8793.19	16290.223
441.24	22901.95	17896.56	8918.5	16572.337
443.14	23275.72	18267.5	9091.49	16878.237
445.02	24123.41	18927.5	9387.06	17479.323
446.87	25025.78	19617.47	9715.54	18119.597
448.71	25590.91	19982.98	9892.47	18488.787
450.53	25979.83	20294.14	10044.78	18772.917
452.33	26632.93	20831.53	10308.71	19257.723
454.11	27388.34	21473.71	10601.68	19821.243
455.88	27832.56	21894.76	10801.39	20176.237
457.63	27806.96	21866.45	10809.46	20160.957
459.36	27728.13	21958.05	10869.51	20185.23
461.08	28134.07	22315.88	11012.26	20487.403
462.78	28514.95	22585.17	11141.63	20747.25

464.47	28607.27	22641.94	11169.61	20806.273	542.3	28377.06	23519.81	12775.49	21557.453
466.15	28813.6	22793.22	11232.09	20946.303	543.74	28652.74	23777.49	12918.18	21782.803
467.81	29089.28	22957.03	11295.44	21113.917	545.18	28962.2	23992.19	13015.83	21990.073
469.46	29006.01	22833.5	11235.2	21024.903	546.62	29156.58	24132.99	13109.85	22133.14
471.1	28789.07	22653.31	11142.07	20861.483	548.07	29297.68	24238.04	13218.66	22251.46
472.72	28716.66	22555.71	11115.9	20796.09	549.51	29414.68	24259.86	13314.46	22329.667
474.33	28785.48	22578.29	11152.06	20838.61	550.96	29436.96	24330.32	13384.37	22383.883
475.94	28872.94	22636.03	11182.25	20897.073	552.41	29369.27	24439.29	13461.74	22423.433
477.53	29115.35	22893.44	11336.25	21115.013	553.86	29169.7	24384.96	13455.29	22336.65
479.11	29379.93	23148.73	11451.17	21326.61	555.32	28975.05	24160.14	13413.47	22182.887
480.68	29403.99	23268.57	11514.93	21395.83	556.77	28864.22	24060.3	13401.68	22108.733
482.24	29393.39	23354.67	11583.49	21443.85	558.23	29011.48	24204.97	13469.32	22228.59
483.8	29487.66	23472.91	11626.74	21529.103	559.69	29237.58	24370.9	13534.76	22381.08
485.34	29483.29	23512.37	11654.86	21550.173	561.16	29383.29	24317.35	13574.03	22424.89
486.88	29340.45	23473.95	11646.91	21487.103	562.62	29326.74	24225.63	13593.9	22382.09
488.41	28833.37	23164.4	11504.22	21167.33	564.09	29248.46	24236.48	13636.43	22373.79
489.93	27881.52	22427.64	11136.05	20481.737	565.56	29032.99	24176.9	13630.52	22280.137
491.45	27198.39	21789.43	10892.87	19960.23	567.03	28644.94	24060.78	13631.77	22112.497
492.95	27699.34	22177.82	11041.84	20306.333	568.51	28409.91	24040.24	13705.08	22051.743
494.46	28352.76	22682.93	11256.05	20763.913	569.99	28562.88	24224.07	13784.4	22190.45
495.95	28367.47	22653.85	11230.21	20750.51	571.47	28760.34	24392.21	13791.3	22314.617
497.44	28290.46	22587.72	11223.04	20700.407	572.95	28845.29	24407.74	13769.21	22340.747
498.93	28564.24	22725.53	11270	20853.257	574.44	28969.08	24356.56	13733.88	22353.173
500.41	28617.05	22728.35	11292.12	20879.173	575.93	29190.8	24300.89	13703.49	22398.393
501.88	28370.97	22555.58	11221.47	20716.007	577.42	29307.45	24258.99	13700.75	22422.397
503.35	28000.36	22335.47	11149.3	20495.043	578.92	29260.62	24167.27	13612.81	22346.9
504.82	27693.6	22114.2	11053.24	20287.013	580.42	29007.21	23969.76	13418.95	22131.973
506.28	27688.37	22175.1	11129.09	20330.853	581.92	28552.68	23581.03	13149.52	21761.077
507.74	27902.63	22374.84	11241.32	20506.263	583.42	27702.4	22987.31	12744.27	21144.66
509.2	28217.17	22697.91	11397.56	20770.88	584.93	26976.25	22493.6	12403.24	20624.363
510.65	28164.15	22716.66	11424.89	20768.567	586.44	26891.73	22484.34	12275.34	20550.47
512.1	28065.33	22651.61	11420.71	20712.55	587.95	26782.26	22495.33	12205.64	20494.41
513.55	27977.16	22596.18	11433.35	20668.897	589.47	26513.23	22308	12024.4	20281.877
514.99	27618.46	22430.04	11376.67	20475.057	590.99	26256.76	22072.95	11841.01	20056.907
516.44	27041.73	22052.67	11274.85	20123.083	592.51	25946.77	21750.39	11628.27	19775.143
517.88	26562.15	21737.62	11145.4	19815.057	594.03	25829.34	21509.66	11404.39	19581.13
519.32	26085.47	21320.13	11028.42	19478.007	595.56	25850.11	21399.96	11153.39	19467.82
520.76	26429.5	21572.36	11163.73	19721.863	597.09	25811.81	21398.43	10977.3	19395.847
522.2	27214.3	22229.25	11439.95	20294.5	598.62	25797.69	21352.15	10851.07	19333.637
523.63	27716	22557.92	11628.43	20634.117	600.16	25843.62	21168.75	10747.33	19253.233
525.07	28064.29	22769.06	11785.05	20872.8	601.7	25715.75	20923.19	10636.42	19091.787
526.5	28186.53	22783.06	11788.49	20919.36	603.24	25438.35	20788.16	10501.29	18909.267
527.94	28339.8	22691.87	11785.6	20939.09	604.79	25029.21	20616.69	10380.22	18675.373
529.37	28795.55	23114.66	11971.44	21293.883	606.34	24660.14	20356.72	10254.8	18423.887
530.81	28845.38	23415.26	12178.4	21479.68	607.89	24401.29	20180.65	10126.13	18236.023
532.24	28666.59	23314.03	12239.58	21406.733	609.44	24390.37	20163.65	10040.13	18198.05
533.67	28623.95	23142.87	12279.09	21348.637	611	24693.92	20164.28	9981.52	18279.907
535.11	28724.33	23285.45	12387.23	21465.67	612.56	25032.47	20181.43	9950.41	18388.103
536.55	28816.64	23464.21	12448.52	21576.457	614.12	25111.65	20090.31	9924.39	18375.45
537.98	28727.83	23461.34	12511.09	21566.753	615.69	24884.56	19897.67	9870.27	18217.5
539.42	28406.39	23274.96	12500.8	21394.05	617.25	24510.29	19714.91	9779.75	18001.65
540.86	28239.72	23300.47	12623.19	21387.793	618.82	24179.67	19702.87	9684.48	17855.673

620.4	23898.66	19702.04	9593.33	17731.343	704.45	18902.82	15114.77	6082.43	13366.673
621.97	23653.41	19621.55	9523.66	17599.54	706.08	18810.79	15022.4	5963.73	13265.64
623.55	23505.58	19465.63	9439.78	17470.33	707.71	18639.42	14845.76	5832.21	13105.797
625.13	23480.37	19403.69	9423.45	17435.837	709.34	18372.28	14630.77	5667.9	12890.317
626.71	23558.72	19437.31	9448.17	17481.4	710.97	17812.73	14204.78	5410.39	12475.967
628.3	23652.43	19488.96	9469.72	17537.037	712.6	16730.11	13299.56	5005.46	11678.377
629.89	23612.83	19414.34	9447.49	17491.553	714.23	15199.39	12094.89	4492.87	10595.717
631.47	23668.37	19289.66	9383.97	17447.333	715.86	14082.85	11277.16	4165.79	9841.9333
633.07	23801.83	19243.39	9333.32	17459.513	717.49	14252.02	11403.17	4162.86	9939.35
634.66	23840.5	19191.63	9319.83	17450.653	719.11	14892.48	11764.69	4223.38	10293.517
636.26	23925.41	19231.34	9327.54	17494.763	720.74	14860.29	11751.48	4158.58	10256.783
637.86	23622.12	19247.79	9290.62	17386.843	722.36	14376.02	11453.99	4022.48	9950.83
639.46	22950.09	19050.25	9261.02	17087.12	723.99	14306.08	11324.08	3952.58	9860.9133
641.06	22162.79	18707.36	9163.62	16677.923	725.61	14346.47	11334.73	3911.82	9864.34
642.66	21440.24	18521.92	9051.78	16337.98	727.23	14495.96	11449.55	3933.18	9959.5633
644.27	20829.14	18388.82	8947.41	16055.123	728.85	14904.63	11752.46	4024.19	10227.093
645.88	20678.27	18258.02	8869.93	15935.407	730.47	15506.47	12210.45	4144.56	10620.493
647.49	21334.08	18219.77	8704.84	16086.23	732.08	16024.69	12560.58	4226.66	10937.31
649.1	21861.28	18141.78	8415.09	16139.383	733.7	16184.83	12699.14	4277.39	11053.787
650.71	21878.27	17997.07	8180.24	16018.527	735.32	16190.53	12718.94	4287.48	11065.65
652.32	22337.43	18063.8	8120.97	16174.067	736.93	16239.73	12747.84	4295.84	11094.47
653.94	23126.02	18032.47	8154.65	16437.713	738.54	16315.2	12804.33	4317.28	11145.603
655.56	23379.79	17651.62	8100	16377.137	740.15	16477.72	12909.48	4374.78	11253.993
657.18	23375.79	17486.48	8011.68	16291.317	741.76	16584.05	13012.94	4387.64	11328.21
658.8	23140.33	17673.94	7931.62	16248.63	743.37	16668.13	13055.02	4426.31	11383.153
660.42	22894.22	17944.74	7854.42	16231.127	744.97	16686.62	13073.51	4437.75	11399.293
662.04	22616.84	17949.3	7742.3	16102.813	746.58	16646.22	13032.18	4416.2	11364.867
663.66	22210.38	17774.58	7656.78	15880.58	748.18	16504.53	12958.29	4397.62	11286.813
665.29	21822.68	17534.04	7589.02	15648.58	749.78	16432.04	12883.81	4378.25	11231.367
666.92	21576.84	17402.87	7578.92	15519.543	751.38	16393.31	12858.82	4351.24	11201.123
668.54	21507.29	17356.74	7573.49	15479.173	752.98	16352.38	12808.05	4348.31	11169.58
670.17	21532.11	17368.6	7593.96	15498.223	754.57	16150.13	12680.84	4304.89	11045.287
671.8	21559.38	17399.63	7621.7	15526.903	756.16	15232.01	11961.21	4023.07	10405.43
673.43	21543.22	17415.61	7655.13	15537.987	757.76	12604.51	9897.98	3316	8606.1633
675.06	21519.53	17411.42	7675.82	15535.59	759.35	9379.73	7679.44	2634.88	6564.6833
676.69	21447.71	17360.58	7675.4	15494.563	760.93	8147.72	6655.83	2361.69	5721.7467
678.32	21248.62	17232.85	7614.28	15365.25	762.52	9168.62	7258.18	2515.46	6314.0867
679.95	20728.79	16769.6	7439.7	14979.363	764.1	10741.43	8489.47	2914.3	7381.7333
681.58	19700.09	15952.03	7113.08	14255.067	765.69	12685.13	9971.98	3393.36	8683.49
683.22	18751.66	15293.14	6833.01	13625.937	767.27	14261.48	11166.97	3784.33	9737.5933
684.85	18761.8	15231.72	6798.99	13597.503	768.85	15039.46	11861.48	4022.59	10307.843
686.48	19196.86	15554.74	6863.2	13871.6	770.42	15346.96	12153.82	4116.33	10539.037
688.12	19387.18	15660.22	6865.13	13970.843	772	15452.88	12233.69	4146.52	10611.03
689.75	19370.27	15659.58	6824.17	13951.34	773.57	15485.57	12264.83	4179.49	10643.297
691.38	19445.77	15716.15	6817.33	13993.083	775.14	15487.32	12276.66	4182.94	10648.973
693.02	19605.41	15805.44	6786.6	14065.817	776.7	15473.13	12266.4	4157.46	10632.33
694.65	19421.71	15673.66	6674.51	13923.293	778.27	15433.37	12256.96	4165.06	10618.463
696.29	19050.53	15367.72	6498.2	13638.817	779.83	15415.01	12246.37	4186.35	10615.91
697.92	18848.09	15202.32	6353.8	13468.07	781.4	15398.58	12223.12	4156.82	10592.84
699.55	18882.37	15185.51	6312.44	13460.107	782.96	15337.1	12158.31	4140.24	10545.217
701.19	18966.25	15216.7	6252.24	13478.397	784.51	15239.85	12099.1	4130.76	10489.903
702.82	18963.51	15198.61	6172.71	13444.943	786.07	15130.19	12012.3	4098.77	10413.753

787.62	14899.18	11859.89	4022.05	10260.373	865.69	11911.06	9659.48	3239.52	8270.02
789.17	14678.87	11697.16	3965.45	10113.827	867.15	12170.94	9802.18	3294.66	8422.5933
790.72	14533.36	11570.28	3941.91	10015.183	868.62	12442.48	10006.03	3357.03	8601.8467
792.27	14454.46	11517.5	3922.12	9964.6933	870.08	12527.59	10085.63	3362.96	8658.7267
793.81	14407.92	11496.94	3923.41	9942.7567	871.54	12518.81	10082.81	3358.79	8653.47
795.35	14415.44	11460.14	3919.53	9931.7033	873	12502.46	10013.59	3354	8623.35
796.89	14441.12	11481.48	3915.38	9945.9933	874.46	12477.91	10021.65	3358.82	8619.46
798.43	14433.92	11466.79	3934.2	9944.97	875.91	12517.45	10048.22	3345.1	8636.9233
799.97	14321.13	11390.49	3871.1	9860.9067	877.37	12464.04	10010.08	3344.25	8606.1233
801.5	14203.94	11304.29	3853.93	9787.3867	878.83	12378.35	9949.5	3306.75	8544.8667
803.03	14153.6	11273.45	3857.69	9761.58	880.29	12365.37	9939.44	3257.49	8520.7667
804.56	14159.85	11300.9	3867.2	9775.9833	881.74	12367.42	9926.92	3314.47	8536.27
806.09	14222.8	11333.13	3894.58	9816.8367	883.2	12336.49	9897.15	3287.96	8507.2
807.61	14194.82	11282.94	3851.55	9776.4367	884.66	12198.27	9806.39	3263.19	8422.6167
809.14	13967	11139.31	3803.78	9636.6967	886.11	12165.58	9744.03	3244.61	8384.74
810.66	13634.93	10841.71	3684.93	9387.19	887.57	12181.18	9769.07	3242.57	8397.6067
812.17	13036.48	10357.72	3468.14	8954.1133	889.03	12067.97	9664.16	3203.92	8312.0167
813.69	12145.19	9692.98	3253.85	8364.0067	890.48	11720.67	9441.85	3112.97	8091.83
815.21	11334.64	9088.76	3047.12	7823.5067	891.94	11104.21	8954.07	2947.41	7668.5633
816.72	11010.65	8783.39	2978.53	7590.8567	893.39	10267.36	8333.94	2721.51	7107.6033
818.23	11181.29	8865.9	2984.61	7677.2667	894.85	9425.31	7660.88	2543.64	6543.2767
819.74	11675.87	9182.71	3068.31	7975.63	896.31	8753.39	7139.62	2294.47	6062.4933
821.25	11752.25	9243.54	3072.86	8022.8833	897.76	8357.67	6833.12	2239.92	5810.2367
822.75	11455.01	9113.08	3060.38	7876.1567	899.22	8468.51	6821.96	2230.03	5840.1667
824.25	11766.55	9313.81	3123.3	8067.8867	900.68	9083.13	7255.08	2350.35	6229.52
825.75	12370	9651.17	3190.43	8403.8667	902.14	9795.5	7751.3	2553.17	6699.99
827.25	12241.74	9670.56	3195.76	8369.3533	903.59	9754.65	7822.52	2539.11	6705.4267
828.75	12051.55	9532.57	3146.75	8243.6233	905.05	8938.21	7304.34	2359.06	6200.5367
830.25	12093.73	9545.44	3150.71	8263.2933	906.51	8349.16	6816.47	2204.93	5790.1867
831.74	12220.89	9619.44	3166.98	8335.77	907.97	8302.31	6717.2	2200.78	5740.0967
833.23	12388.1	9745.77	3223.14	8452.3367	909.43	8369.11	6729.12	2203.88	5767.37
834.72	12716.26	9990.36	3297.01	8667.8767	910.89	8180.81	6660.14	2127.01	5655.9867
836.21	12958.86	10242.26	3382.51	8861.21	912.35	7981.67	6461.35	2073.16	5505.3933
837.7	13160.67	10367.73	3407.95	8978.7833	913.82	7990.3	6443.79	2102.45	5512.18
839.18	13229.13	10484.59	3474.89	9062.87	915.28	8157.29	6602.54	2197.39	5652.4067
840.67	13322.11	10563.12	3497.02	9127.4167	916.74	8667.28	6908.32	2237.23	5937.61
842.15	13293.15	10563.88	3499.89	9118.9733	918.21	9137.97	7299.5	2371.52	6269.6633
843.63	13303.17	10571.06	3482.33	9118.8533	919.68	9101.48	7305.72	2409.22	6272.14
845.11	13286.97	10583.68	3505.04	9125.23	921.14	8882.77	7179.38	2332.15	6131.4333
846.59	13264.55	10530.15	3510.05	9101.5833	922.61	8704.53	7060.73	2310.68	6025.3133
848.07	13022.56	10405.21	3467.38	8965.05	924.08	8369.63	6819.04	2125.34	5771.3367
849.54	12730.68	10191.36	3394.02	8772.02	925.55	7496.45	6169.21	2009.29	5224.9833
851.02	12572.83	10063.91	3352.54	8663.0933	927.02	6084.94	5140.08	1694.46	4306.4933
852.49	12254.78	9819.11	3266.67	8446.8533	928.49	4779.55	4119.86	1364.66	3421.3567
853.96	11985.05	9645.25	3230.08	8286.7933	929.97	3640.52	3207.92	1091.49	2646.6433
855.43	12298.91	9815.07	3296.61	8470.1967	931.44	2993.83	2603.33	924.87	2174.01
856.9	12678.98	10130.72	3394.4	8734.7	932.92	2928.86	2437.21	934.15	2100.0733
858.37	12717.65	10211.06	3374	8767.57	934.4	3139.68	2615.2	934	2229.6267
859.83	12683.79	10197.94	3421.35	8767.6933	935.88	3728.2	3026.42	1081.91	2612.1767
861.3	12682.12	10199.32	3379.91	8753.7833	937.36	4469.9	3564.04	1202.86	3078.9333
862.76	12578.3	10090.39	3406.42	8691.7033	938.84	4473.33	3726.52	1199.43	3133.0933
864.23	12174.4	9871.49	3296	8447.2967	940.32	4046.89	3382.71	1119.85	2849.8167

941.81	3790.52	3191.6	1087.51	2689.8767	1020.8	9462.17	7889.66	2846.79	6732.8733
943.29	3708.42	3145.32	1110.11	2654.6167	1022.33	9487.17	8184.45	2831.99	6834.5367
944.78	3806.85	3225.59	1105.22	2712.5533	1023.86	9426.78	7865.47	2975.33	6755.86
946.27	3992.82	3375.97	1208.68	2859.1567	1025.39	9558.17	7554.04	2836.62	6649.61
947.76	4167.5	3422.1	1194.35	2927.9833	1026.91	9752.96	8020.53	2951.55	6908.3467
949.25	4165.96	3458.7	1233.4	2952.6867	1028.44	9610.21	8069.89	2712.29	6797.4633
950.74	4163.63	3488.68	1183.35	2945.22	1029.96	9636.99	7814.72	3118.88	6856.8633
952.24	4315.65	3550.4	1147.87	3004.64	1031.48	9848.62	7908.18	3038.79	6931.8633
953.74	4428.8	3597.27	1256.33	3094.1333	1033	9643.43	7997.92	2831.8	6824.3833
955.23	4631.73	3878.16	1314.16	3274.6833	1034.51	9778.98	7823.18	3312.88	6971.68
956.73	4700.77	3900.25	1340.42	3313.8133	1036.02	9685.42	8349.5	2838.83	6957.9167
958.24	4961.51	4110.97	1398.67	3490.3833	1037.53	9408.79	7884.22	3049.15	6780.72
959.74	5351.83	4268.03	1429.07	3682.9767	1039.03	9799.99	7840	3099.53	6913.1733
961.24	5612.56	4581.49	1527.16	3907.07	1040.54	9990.62	8030.74	3346.14	7122.5
962.75	5890.55	4795.32	1608.31	4098.06	1042.03	9955.6	7964.48	3434.68	7118.2533
964.26	6417.58	5174.18	1744.78	4445.5133	1043.53	9638.08	8179.34	3594.74	7137.3867
965.77	7186.28	5765.27	1938.67	4963.4067	1045.02	9552.3	8406.03	3165.91	7041.4133
967.28	7686.74	6283.53	2084.19	5351.4867	1046.5	10016.4	8195.24	3243.95	7151.8633
968.79	8088.32	6456.01	2124.1	5556.1433	1047.98	9618.57	8431.09	3443.69	7164.45
970.3	7786.12	6424.61	2180.54	5463.7567	1049.46	10364.4	8192.22	2854.87	7137.1633
971.82	7268.29	6120.1	2058.09	5148.8267	1050.93	9775.66	8610.35	3236.97	7207.66
973.34	7203.92	6012.46	2051.96	5089.4467	1052.39	10255	8096.06	2901.09	7084.05
974.85	7499.91	6143.43	2017.91	5220.4167	1053.85	10133.14	8574.19	3543.05	7416.7933
976.37	7706.74	6327.28	2052.09	5362.0367	1055.3	10184.93	8339.83	3763.99	7429.5833
977.9	7879.85	6461.94	2231.46	5524.4167	1056.75	10345.15	8199.49	2988.6	7177.7467
979.42	8259.25	6671.39	2275.15	5735.2633	1058.19	10206.48	8759.89	3134.27	7366.88
980.94	8640.09	7035.16	2365.16	6013.47	1059.62	10559.89	8813.77	3575.4	7649.6867
982.47	8797.93	7149.09	2399.44	6115.4867	1061.05	10051.99	8915.67	3146.71	7371.4567
983.99	9117.54	7346.78	2486.6	6316.9733	1062.46	9690.38	7862	3382.49	6978.29
985.52	9299.23	7503.52	2590.96	6464.57	1063.87	10974.69	8588.89	4008.15	7857.2433
987.05	9423.12	7507	2559.2	6496.44	1065.27	10536.27	8945.89	3081.36	7521.1733
988.58	9418.55	7645.02	2566.25	6543.2733	1066.67	9885.85	8662.86	3465.14	7337.95
990.11	9499.19	7753.32	2680.67	6644.3933	1068.05	10537.97	9077.26	4590.8	8068.6767
991.64	9413.5	7901.12	2685.53	6666.7167	1069.42	10260.34	9939.7	3526.99	7909.01
993.17	9471.76	7820.72	2693.8	6662.0933	1070.79	10178.7	8879.29	3898.23	7652.0733
994.71	9699.53	7825.08	2722.41	6749.0067	1072.14	10375.61	8518.93	3931.81	7608.7833
996.24	9646.47	7796.67	2767.05	6736.73	1073.48	11126.97	8482.94	3194.87	7601.5933
997.77	9458.06	7850.19	2727.08	6678.4433	1074.82	10924.73	9159.12	4303.68	8129.1767
999.31	9437.33	7818.58	2800.44	6685.45	1076.14	11079.76	8531.42	3434.73	7681.97
1000.85	9481.77	7789.8	2663.61	6645.06	1077.44	10123.73	9233.73	4004.99	7787.4833
1002.38	9363.82	7788.76	2613.56	6588.7133	1078.74	11165.77	8571.7	3834.71	7857.3933
1003.92	9320.82	7713.78	2785.53	6606.71	1080.02	10803.59	9309.47	3792.75	7968.6033
1005.45	9362.8	7789.99	2812.54	6655.11	1081.3	10962.63	9096.65	4781.57	8280.2833
1006.99	9500.31	7833.92	2719.85	6684.6933	1082.55	11154.91	9612.21	4865.44	8544.1867
1008.53	9318.65	7930.77	2795.6	6681.6733	1083.79	11317.85	9964.62	4551.74	8611.4033
1010.06	9559.32	7952.37	2698.86	6736.85	1085.02	10805.01	9171.69	4397.39	8124.6967
1011.6	9543.76	7810.48	2867.41	6740.55	1086.24	10873.36	9578.91	4142.23	8198.1667
1013.13	9438.4	7883.84	2842.62	6721.62	1087.43	10977.68	10308.31	5622.71	8969.5667
1014.67	9560.31	7897.65	2886.57	6781.51	1088.62	12300.57	10780.27	5113.72	9398.1867
1016.2	9740.18	8060.84	2878.87	6893.2967	1089.78	12072.33	8910.53	4742.7	8575.1867
1017.74	9605.34	7879.38	2726.52	6737.08					
1019.27	9755.72	7934.65	2913.71	6868.0267					

APPENDIX C-1C

DOWNWELLING IRRADIANCE AVERAGE CALCULATION

FEBRAUARY 24, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0.04	0.04	0.04	0.04
115.33	0.23	0.23	0.22	0.2266667
122.58	0.24	0.25	0.24	0.2433333
129.71	0.26	0.27	0.26	0.2633333
136.72	0.28	0.28	0.27	0.2766667
143.6	0.29	0.31	0.31	0.3033333
150.37	0.32	0.31	0.3	0.31
157.02	0.32	0.32	0.32	0.32
163.55	0.34	0.35	0.35	0.3466667
169.97	0.35	0.36	0.35	0.3533333
176.28	0.38	0.37	0.37	0.3733333
182.48	0.39	0.38	0.39	0.3866667
188.57	0.41	0.42	0.4	0.41
194.55	0.42	0.44	0.42	0.4266667
200.43	0.43	0.44	0.42	0.43
206.21	0.44	0.46	0.45	0.45
211.88	0.46	0.47	0.45	0.46
217.46	0.5	0.51	0.47	0.4933333
222.94	0.51	0.49	0.5	0.5
228.33	0.5	0.54	0.52	0.52
233.62	0.54	0.54	0.53	0.5366667
238.82	0.53	0.56	0.54	0.5433333
243.92	0.57	0.56	0.57	0.5666667
248.94	0.58	0.56	0.59	0.5766667
253.87	0.81	0.84	0.8	0.8166667
258.72	1.12	1.14	1.11	1.1233333
263.48	1.86	1.84	1.75	1.8166667
268.16	2.73	2.64	2.72	2.6966667
272.75	3.96	4.05	3.94	3.9833333
277.27	5.31	5.45	5.33	5.3633333
281.71	10.87	11.39	10.84	11.033333
286.07	22.14	22.25	21.8	22.063333
290.36	33.69	34.19	34.53	34.136667
294.57	49.08	50.14	49.2	49.473333
298.71	64.88	67.3	65.18	65.786667
302.78	152.35	154.7	152.01	153.02
306.78	282.51	290.15	281.92	284.86
310.71	439.58	442.08	450.42	444.02667
314.57	655.87	659.23	648.05	654.38333
318.37	883.92	910.2	890.83	894.98333
322.1	1512.88	1506.69	1519.07	1512.88
325.77	2568.93	2617.75	2514.02	2566.9
329.38	3889.67	3873.96	3889.67	3884.4333
332.93	6714.9	6726.49	6645.31	6695.5667
336.42	10075.88	10206.53	10237.28	10173.23
339.85	13635.39	13818.42	13653.7	13702.503
343.22	16803.85	17024.96	17045.06	16957.957
346.53	20279.22	20343.8	20429.91	20350.977
349.79	23577.46	23712.19	23689.73	23659.793
353	27444.31	27491.63	27326.02	27420.653
356.16	30009.13	30057.64	29839.31	29968.693
359.26	32504.2	32676.57	32676.57	32619.113
362.32	35869.19	35745.08	35968.49	35860.92
365.32	40253.79	40452.82	40303.55	40336.72
368.28	44779.05	44655.14	44828.61	44754.267
371.19	49443.44	49443.44	49418.34	49435.073
374.05	54104.1	54451.33	54014.07	54189.833
376.87	58354.91	58368.07	58210.17	58311.05
379.64	63015.36	63095.64	62801.3	62970.767
382.37	71270.2	71569.77	71052.33	71297.433
385.06	82747.08	82829.41	82472.63	82683.04
387.71	95715.98	95715.98	95578.81	95670.257
390.32	107842.39	107964.68	107855.98	107887.68
392.89	117791.77	118254.44	117982.28	118009.5
395.42	123959.41	124298.43	124027.21	124095.02
397.92	128563.69	128617.5	128186.98	128456.06
400.37	133237.71	133518.38	133331.27	133362.45
402.8	139710.12	140032.59	139629.5	139790.74
405.18	146317.5	146762.48	146115.24	146398.41
407.54	152573.15	152586.68	152505.47	152555.1
409.86	157821.6	158065.62	157442.03	157776.42
412.15	162373.6	162523.53	162578.04	162491.72
414.4	165879.87	166235.07	165743.25	165952.73
416.63	168447.54	168884.43	168283.71	168538.56
418.83	171321.4	171594.04	171185.09	171366.84
420.99	173221.05	173451.27	173017.91	173230.08
423.13	174859.31	175223.46	174737.92	174940.23
425.25	175616.17	176032.54	175871.37	175840.03
427.33	175845.81	176285.25	175859.12	175996.73
429.39	174181.51	174550.65	173891.47	174207.88
431.43	173533.24	173991.45	173572.51	173699.07
433.44	179141.58	179569.69	178869.15	179193.47
435.42	189906.54	190214.87	189726.68	189949.36
437.38	199809.49	200178.78	199975.03	199987.77
439.32	205793.12	206360.32	205654.47	205935.97
441.24	209605.99	210069.85	209392.86	209689.57
443.14	213438	213826.14	213450.52	213571.55
445.02	220519.29	221132.78	220456.69	220702.92
446.87	228612.06	229175.91	228424.11	228737.36
448.71	233295.09	233848.33	233370.53	233504.65
450.53	236731.38	237461.56	236882.45	237025.13
452.33	242686.04	243227.61	242723.83	242879.16
454.11	249586.74	250278.32	249574.16	249813.07
455.88	254074.78	254936.65	254037.31	254349.58
457.63	254409.04	255134.69	254298.35	254614.03
459.36	254681.33	255309.7	254608.83	254866.62
461.08	257763.29	258402.19	257786.95	257984.14
462.78	260604.07	261632.57	260823.64	261020.09

464.47	261201.36	261982.22	261280.58	261488.05	542.3	239355.37	240285.53	239583.17	239741.36
466.15	262453.89	263167.75	262409.28	262676.97	543.74	240398.69	241463.15	240772.18	240878.01
467.81	263833.83	264725.79	264131.15	264230.26	545.18	240738.58	241598.75	240683.67	241007
469.46	262717.45	263747.8	262870.91	263112.05	546.62	240341.63	241150.25	240575.23	240689.04
471.1	260064.98	260921.32	260306.51	260430.94	548.07	240240.32	241161.25	240564.84	240655.47
472.72	258622.23	259206.63	258677.36	258835.41	549.51	240008.31	240884.63	240197.32	240363.42
474.33	258630.92	259532.78	258530.72	258898.14	550.96	239206.55	240159.56	239248.72	239538.28
475.94	259189.54	259729.8	259076.99	259332.11	552.41	238523.78	239511.65	238797.73	238944.39
477.53	260965.97	261804.43	261283.23	261351.21	553.86	236777.04	237884.05	237211.64	237290.91
479.11	263388.24	264504.87	263456.6	263783.24	555.32	234099.33	235142.81	234588.46	234610.2
480.68	264354.59	265332.16	264513.73	264733.49	556.77	232151.9	233096.8	232314.82	232521.17
482.24	264738.06	265629.97	264591.29	264986.44	558.23	231730.64	232732.17	232239.61	232234.14
483.8	265487.5	266109.67	265531.94	265709.7	559.69	232141.17	233033.42	232616.48	232597.02
485.34	265908.66	266887.95	266060.99	266285.87	561.16	231680.51	232582.26	231969.75	232077.51
486.88	265114.47	266099.95	265061.49	265425.3	562.62	230683.13	231490.11	230726.51	230966.58
488.41	261891.39	262685.41	261901.71	262159.5	564.09	229940.65	231037.09	230056.53	230344.76
489.93	253738.41	254581.32	253999.31	254106.35	565.56	229122.9	229924.09	229341.4	229462.8
491.45	246565.99	247204.94	246556.16	246775.7	567.03	228110.13	229029.51	228249.43	228463.02
492.95	248609.75	249353.19	248735.26	248899.4	568.51	228450.2	229517.24	228610.73	228859.39
494.46	254652.81	255465.18	254700.6	254939.53	569.99	229689.68	230675.39	230005.49	230123.52
495.95	255186.6	256103.65	255358.55	255549.6	571.47	229919.11	230785.28	230073.1	230259.16
497.44	254219.24	255121.89	254180.83	254507.32	572.95	229486.84	230491.75	229834.7	229937.76
498.93	254977.95	255870.43	255210.77	255353.05	574.44	229736.42	230585.37	229910.07	230077.29
500.41	255107.35	256033.58	255028.53	255389.82	575.93	230217.71	231243.88	230361.57	230607.72
501.88	252742.71	253403.6	252862.87	253003.06	577.42	230883.1	231843.81	230911.64	231212.85
503.35	249707.79	250704.26	250012.83	250141.63	578.92	230766.94	231791.48	231020.72	231193.05
504.82	246678.01	247687.29	246739.8	247035.03	580.42	229387.07	230172.55	229544.17	229701.26
506.28	246379.62	247355.83	246358.85	246698.1	581.92	226750.23	227667.59	227158.96	227192.26
507.74	247701.31	248522.16	247732.48	247985.32	583.42	222442.15	223587.1	222799.94	222943.06
509.2	250074.94	250780.08	250095.68	250316.9	584.93	219077.3	219746.62	219306.28	219376.73
510.65	249386.64	250277.49	249417.36	249693.83	586.44	219277.4	220033.14	219355.58	219555.37
512.1	248032.73	248736.63	248012.62	248260.66	587.95	221048.3	222020.8	221194.61	221421.24
513.55	247180.8	248154.69	247308.69	247548.06	589.47	221686.11	222377.74	221848.35	221970.73
514.99	245049.29	246055.12	245212.14	245438.85	590.99	222212.02	223062.82	222467.26	222580.7
516.44	241672.54	242529.27	241653.92	241951.91	592.51	222693.01	223381.78	222939.61	223004.8
517.88	237345.41	238052.76	237309.13	237569.1	594.03	222596.15	223768.02	222861.32	223075.16
519.32	232116.63	232966.16	232346.71	232476.5	595.56	222688.79	223584.85	222740.48	223004.71
520.76	232205.51	233004.01	232274.95	232494.82	597.09	222974.63	223916.85	223131.67	223341.05
522.2	236997.51	237753.37	236997.51	237249.46	598.62	223625.92	224657.03	223857.03	224046.66
523.63	240078.35	240994.58	239932.78	240335.24	600.16	223723.75	224773.93	223959.14	224152.27
525.07	241251.42	242263.71	241457.31	241657.48	601.7	223072.94	224097.69	223303.74	223491.46
526.5	240659.24	241735.16	241127.79	241174.06	603.24	221943.48	222983.89	222065.33	222330.9
527.94	238507.29	239422.93	238648.15	238859.46	604.79	220678.07	221799.61	220868.16	221115.28
529.37	240056.3	240979.77	240065.27	240367.11	606.34	219699.9	220701.42	219873.24	220091.52
530.81	242842.16	243846.47	243189.11	243292.58	607.89	218778.88	219584.9	218943.97	219102.58
532.24	243146.38	243947.98	243183.66	243426.01	609.44	218008.75	219009.33	218263.8	218427.29
533.67	241840.85	242722.76	242210.68	242258.1	611	217748.99	218430.48	217837.88	218005.78
535.11	242178.27	243111.61	242264.87	242518.25	612.56	218159.07	219241.77	218367.66	218589.5
536.55	242151.09	243122.49	242461.94	242578.51	614.12	218672.65	219748.39	218931.63	219117.56
537.98	241219.35	242124.47	241423.74	241589.19	615.69	218011.41	218779.58	218200.96	218330.65
539.42	239232.07	240046.31	239270.85	239516.41	617.25	216750.84	217447.09	216810.52	217002.82
540.86	238429.25	239447.85	238640.66	238839.25	618.82	215212.96	215915.39	215242.64	215457

620.4	214121.02	215200.85	214533.32	214618.4	704.45	191907.77	192602.22	192099.34	192203.11
621.97	213287.08	214143.57	213618	213682.88	706.08	191949.03	192672.64	192262.6	192294.76
623.55	212556.27	213403.49	212864.35	212941.37	707.71	191614.09	192377.97	191917.21	191969.76
625.13	212637.63	213402.3	212675.86	212905.26	709.34	190285.35	191029.08	190321.93	190545.45
626.71	213060.64	213981.25	213259.95	213433.95	710.97	185932.27	186803.57	186140.89	186292.24
628.3	213564.36	214500.34	213876.35	213980.35	712.6	176179.85	177056	176537.72	176591.19
629.89	213368.84	214369.77	213538.81	213759.14	714.23	162361.84	162794.74	162374.21	162510.26
631.47	212941.51	214027.85	213074.92	213348.09	715.86	152617.09	153126.93	152654.39	152799.47
633.07	212972.27	214007.29	213233.44	213404.33	717.49	153377.52	153887.57	153265.55	153510.21
634.66	212852.15	213764.75	213077.84	213231.58	719.11	158674.45	159285.36	158761.72	158907.18
636.26	212207.52	213364.96	212672.47	212748.32	720.74	159066.33	159739.18	159265.69	159357.07
637.86	211682.09	212539.27	212080.78	212100.71	722.36	155841.68	156241.27	155741.78	155941.58
639.46	210503.45	211358.62	210614.12	210825.4	723.99	154820.2	155444.37	155044.9	155103.16
641.06	208495.2	209573.28	208718.95	208929.14	725.61	155245.51	155984.36	155207.94	155479.27
642.66	206823.18	207856.94	207120.01	207266.71	727.23	156988.32	157578.46	157076.22	157214.33
644.27	206152.85	207174.38	206183.8	206503.68	728.85	161421.62	162228.98	161673.92	161774.84
645.88	205691.72	206681.18	206014.6	206129.17	730.47	167935.3	168872.5	168163.27	168323.69
647.49	204557.19	205492	204735.75	204928.31	732.08	173218.18	174122.41	173511.1	173617.23
649.1	201275.41	202205.28	201444.47	201641.72	733.7	175685.33	176441.77	175749.44	175958.85
650.71	198865.13	199711.54	198918.7	199165.12	735.32	176568.8	177445.97	176568.8	176861.19
652.32	200616.01	201441.41	200811.5	200956.31	736.93	177498.5	177953.26	177329.59	177593.78
653.94	205078.59	205807.62	205454.15	205446.79	738.54	178329.7	178985.33	178355.93	178556.99
655.56	207780.6	208832.26	208116.23	208243.03	740.15	179631.96	180425.28	180160.84	180072.69
657.18	209009.76	210189.32	209418.07	209539.05	741.76	181158.05	181997.91	181571.31	181575.76
658.8	209303.37	210320.91	209383.4	209669.23	743.37	182049.63	182750.03	182265.14	182354.93
660.42	209236.38	210387.42	209420.55	209681.45	744.97	182420.42	182896.5	182570.04	182628.99
662.04	208824.82	210067.96	209193.16	209361.98	746.58	181759.98	182653.18	181801.21	182071.46
663.66	208595.33	209496.46	208652.36	208914.72	748.18	181145.01	181673.21	181172.81	181330.34
665.29	208120.42	209117.18	208256.34	208497.98	749.78	180197.88	181040.19	180562.88	180600.32
666.92	207880.5	208636.84	207936.94	208151.43	751.38	179874.68	180569.18	180002.24	180148.7
668.54	208014.74	208830.13	208105.34	208316.74	752.98	179603.37	180292.5	179632.09	179842.65
670.17	207967.66	208912.81	208252.34	208377.6	754.57	177430.26	178387.3	177546.26	177787.94
671.8	207945	208801.21	207979.25	208241.82	756.16	167072.55	167892.54	167453.26	167472.78
673.43	207681.12	208551.9	207818.61	208017.21	757.76	141087.5	141798.86	141561.74	141482.7
675.06	207165.41	208105.71	207417.69	207562.94	759.35	110815.18	111190.52	111130.47	111045.39
676.69	206153.34	207038.91	206417.86	206536.7	760.93	97326.43	97538.2	97144.91	97336.513
678.32	203841.75	204751.09	204175.56	204256.13	762.52	103641.33	104343.67	103732.94	103905.98
679.95	198461.2	199337.82	199037.92	198945.65	764.1	119781.84	120104.37	119520.74	119802.32
681.58	189123.22	189782.34	189227.29	189377.62	765.69	139696.37	140066.35	139603.88	139788.87
683.22	180695.22	181379.1	180845.9	180973.41	767.27	156442.18	157186.26	156597.2	156741.88
684.85	179751.1	180424.33	179727.89	179967.77	768.85	166243.6	167115.46	166056.78	166471.95
686.48	183329.49	184075.4	183376.11	183593.67	770.42	170727.36	171664.22	170945.96	171112.51
688.12	185567.56	186514.27	185766.25	185949.36	772	172808.74	173216.53	172746.01	172923.76
689.75	186626.81	187387.98	186942.99	186985.93	773.57	173432.13	173936.11	173243.14	173537.13
691.38	188153.07	189198.95	188775.9	188709.31	775.14	173502.21	174022.85	173581.09	173702.05
693.02	190130.9	191003.17	190437.38	190523.82	776.7	173508.2	174300.48	173508.2	173772.29
694.65	189783.17	190573.78	189889.37	190082.11	778.27	173368.28	173876.5	173654.16	173632.98
696.29	187941.55	188877.05	188237.59	188352.06	779.83	173078.34	173954.64	173094.27	173375.75
697.92	187334.25	187962.37	187369.8	187555.47	781.4	172878.94	173517.22	173006.59	173134.25
699.55	188369.23	189379.23	188737.58	188828.68	782.96	172227.44	172708.16	172676.11	172537.24
701.19	190167.83	190774.18	190322.39	190421.47	784.51	171528.14	172090.43	171608.47	171742.35
702.82	191273.19	192217.78	191356.89	191615.95	786.07	170138.04	170734.23	170218.61	170363.63

787.62	168161.78	168727.98	168177.95	168355.9	865.69	139243.53	139584.88	139007.21	139278.54
789.17	165918.83	166731.83	166016.39	166222.35	867.15	140607.02	141078.16	140659.37	140781.52
790.72	164231.82	164722.26	164166.43	164373.5	868.62	142738.88	143337.42	142608.77	142895.02
792.27	163433.32	164239.55	163515.59	163729.49	870.08	143598.62	144195.33	143780.23	143858.06
793.81	162932.26	163611.35	162948.83	163164.15	871.54	143540.47	144082.52	143721.16	143781.38
795.35	162958.98	163593.46	162825.41	163125.95	873	142708.19	142656.54	142501.59	142622.11
796.89	163017.62	163639.38	162866.39	163174.46	874.46	142398.36	142604.66	142398.36	142467.13
798.43	162809.32	163608.49	162962.36	163126.72	875.91	142207.05	142413.89	142362.18	142327.71
799.97	161870.49	162264.67	162093.29	162076.15	877.37	141487.92	141513.82	141462.02	141487.92
801.5	160700.95	161341.47	160822.13	160954.85	878.83	140255.5	140775.74	140723.71	140584.98
803.03	160378.27	161060.58	160220.81	160553.22	880.29	139597.35	140330.69	139911.64	139946.56
804.56	160490.04	161215.28	160932.26	160879.19	881.74	140071.77	140467.53	140309.22	140282.84
806.09	160946.07	161714.26	161071.12	161243.82	883.2	139238.95	139824.66	139132.46	139398.69
807.61	160057.94	160601.37	159840.57	160166.63	884.66	137901.73	138709.12	138762.94	138457.93
809.14	157783.66	158295.7	158003.11	158027.49	886.11	137620.34	138382.17	137511.5	137838
810.66	153696.98	154567.84	153789.63	154018.15	887.57	137669.73	138000.54	137835.14	137835.14
812.17	146983.81	148011.4	147600.36	147531.86	889.03	136206.65	136681.82	136122.8	136337.09
813.69	137891.38	138440	138023.81	138118.4	890.48	132583.47	133123	132782.24	132829.57
815.21	129462.15	129844.83	129844.83	129717.27	891.94	126612.47	127103.1	126583.61	126766.39
816.72	125634.42	126542.72	125808.35	125995.16	893.39	118052.5	118965.81	118671.19	118563.17
818.23	126418.44	126926.45	126340.28	126561.72	894.85	109477.47	109867.07	109507.44	109617.33
819.74	129940.33	130493.27	130137.81	130190.47	896.31	102455.63	102363.86	102608.6	102476.03
821.25	130702.56	131321.62	130442.95	130822.38	897.76	98134.2	98697.12	98134.2	98321.84
822.75	128848.68	128949.52	128989.85	128929.35	899.22	98760.61	99112.3	98472.87	98781.927
824.25	131826.21	132254.54	131765.01	131948.59	900.68	103578.7	103480.77	103937.78	103665.75
825.75	136276.12	136605.99	135781.32	136221.14	902.14	110236.95	110737.58	110337.08	110437.2
827.25	135991.6	136532.9	136283.07	136269.19	903.59	110284.77	110250.58	110250.58	110261.98
828.75	134648.15	135049.07	134669.25	134788.82	905.05	103623.81	104078.15	103868.45	103856.8
830.25	134942.29	135837.93	135283.48	135354.57	906.51	98164.3	99096.47	98522.83	98594.533
831.74	136137.15	136805.01	136115.6	136352.59	907.97	96338.01	96742.33	96448.28	96509.54
833.23	138196.93	138393.26	138262.38	138284.19	909.43	96463.3	96989.6	96087.37	96513.423
834.72	141437.66	141879.1	141481.81	141599.52	910.89	95012.91	95320.89	95166.9	95166.9
836.21	144104.92	144929.65	144305.53	144446.7	912.35	92719.69	93114.58	93430.49	93088.253
837.7	146361.27	147106.05	146519.25	146662.19	913.82	92628.88	93154.49	93235.36	93006.243
839.18	148170.8	148809.86	148353.39	148444.68	915.28	94819.47	95441.37	94529.24	94930.027
840.67	148990.8	149682.71	149452.07	149375.19	916.74	99394.78	99649.86	99904.93	99649.857
842.15	149453.01	150106.87	149966.76	149842.21	918.21	104216.35	103824.72	104346.89	104129.32
843.63	149572.04	150280.91	149713.81	149855.59	919.68	104577.81	104845.5	104131.66	104518.32
845.11	150335.29	150883.7	150645.26	150621.42	921.14	102431.9	103163.55	102706.27	102767.24
846.59	149939.18	150422.08	150180.63	150180.63	922.61	101084.9	101833.67	101084.9	101334.49
848.07	148039.51	148675.51	148137.36	148284.13	924.08	97753.49	98088.75	97992.96	97945.067
849.54	145670.45	145819.09	145918.19	145802.58	925.55	88728.47	89269.2	88581	88859.557
851.02	143761.12	144764.69	144062.2	144196	927.02	75135.84	75589.37	74178.37	74967.86
852.49	140727.84	141160.85	141415.56	141101.42	928.49	61364.5	61674.95	61985.39	61674.947
853.96	139205.29	139102.44	139256.71	139188.15	929.97	48930.73	49409.92	48664.51	49001.72
855.43	142060.05	142580.22	141956.01	142198.76	931.44	40995.57	41434.02	40666.73	41032.107
856.9	145509.79	146454.31	145562.26	145842.12	932.92	38096.28	37759.15	39220.07	38358.5
858.37	146622.37	147809.71	146965.38	147132.49	934.4	39659.13	41038.58	40118.95	40272.22
859.83	146956.06	147564.3	147035.39	147185.25	935.88	45791.03	45030.77	46434.32	45752.04
861.3	147113.88	147670.03	146928.5	147237.47	937.36	51797.34	52510.15	52153.75	52153.747
862.76	145534.26	146010.04	145375.67	145639.99	938.84	53348.09	54555.06	53468.79	53790.647
864.23	141632.17	142687.94	142107.27	142142.46	940.32	50354.49	50910.55	50045.57	50436.87

941.81	48102.52	49048.18	48417.74	48522.813	1020.8	115172.82	111485.56	118426.29	115028.22
943.29	47429.19	46850	47750.96	47343.383	1022.33	113506.19	113732.75	113732.75	113657.23
944.78	47876.3	48596.74	48858.72	48443.92	1023.86	115006.77	114064.09	115478.11	114849.66
946.27	49814.38	49747.7	50281.18	49947.753	1025.39	116178.02	118397.98	115438.03	116671.34
947.76	50281.09	50687.67	50823.2	50597.32	1026.91	116265.54	118062.14	114982.25	116436.64
949.25	50992.07	51613.08	51199.07	51268.073	1028.44	116795.8	116795.8	114117	115902.87
950.74	52032.22	52452.97	51330.98	51938.723	1029.96	116064.37	118307.16	117746.46	117372.66
952.24	52250.48	51253.88	53389.45	52297.937	1031.48	115400.9	118915.65	117744.07	117353.54
953.74	54374.84	53651.77	54230.23	54085.613	1033	115414.99	116945.69	114496.57	115619.08
955.23	56463.04	56904.15	55580.8	56315.997	1034.51	118465.36	120700.55	115591.53	118252.48
956.73	57414.61	58978.43	57340.14	57911.06	1036.02	116559.05	116893.03	118896.92	117449.67
958.24	59802.78	59575.97	60785.64	60054.797	1037.53	114647.9	122662.8	119178.06	118829.59
959.74	63991.73	64298.65	63224.45	63838.277	1039.03	116323.66	118146.91	119605.52	118025.36
961.24	67000.59	66922.77	67078.41	67000.59	1040.54	119696.27	113960.03	111665.53	115107.28
962.75	69936.71	70410.32	69778.84	70041.957	1042.03	121856.53	119467.19	115484.95	118936.22
964.26	75406.61	75246.17	75246.17	75299.65	1043.53	120033.13	118366.01	119199.57	119199.57
965.77	84205.37	84773.78	83961.77	84313.64	1045.02	117902.72	121396.13	119649.43	119649.43
967.28	90796.45	91786.95	90631.36	91071.587	1046.5	118375.69	121107.44	125660.35	121714.49
968.79	94004.46	93753.33	94757.83	94171.873	1047.98	116372.82	123497.68	115897.83	118589.44
970.3	91646.41	94965.08	93773.77	93461.753	1049.46	122138.61	112208.64	119159.62	117835.62
971.82	89689.24	90469.14	89429.27	89862.55	1050.93	122228.16	125335.66	125335.66	124299.83
973.34	88609.32	88962.34	88432.8	88668.153	1052.39	120361.35	123060.04	118742.14	120721.18
974.85	90850.98	90402.56	90761.3	90671.613	1053.85	125282.4	116779.07	119046.62	120369.36
976.37	92116.12	91021.67	93028.16	92055.317	1055.3	125171.26	123990.4	126352.12	125171.26
977.9	93907.36	95209.05	94093.31	94403.24	1056.75	123222.22	121383.08	121383.08	121996.13
979.42	97831.28	95935.32	99537.64	97768.08	1058.19	126656.79	127299.72	117012.88	123656.46
980.94	101267.66	101750.35	100398.82	101138.94	1059.62	121729.76	123725.33	126386.09	123947.06
982.47	102966.59	103950.97	105132.23	104016.6	1061.05	124469.81	118875.66	127266.88	123537.45
983.99	108204.84	106898.75	106697.81	107267.13	1062.46	120672.63	130180.17	128717.47	126523.42
985.52	109384.65	108974.21	108358.53	108905.8	1063.87	127497.24	126733.78	129787.61	128006.21
987.05	110557.57	111292.53	111082.54	110977.55	1065.27	128820.85	127230.47	132001.61	129350.98
988.58	112001.51	111786.54	112001.51	111929.85	1066.67	129637.1	128821.77	132083.09	130180.65
990.11	112725.52	111735.74	112395.59	112285.62	1068.05	119360.75	131881.11	135219.87	128820.58
991.64	113075.11	115562.77	112170.51	113602.8	1069.42	129964.26	133384.37	131674.32	131674.32
993.17	114588.02	115167.33	115167.33	114974.23	1070.79	129940.86	143801.21	119545.59	131095.89
994.71	114847.19	115680.28	114728.18	115085.22	1072.14	131934.12	120575.56	122323.03	124944.24
996.24	114962.69	114228.88	116185.69	115125.75	1073.48	124269.57	135727.05	142777.8	134258.14
997.77	114883.96	116018.93	115262.28	115388.39	1074.82	127124.19	123592.96	130655.41	127124.19
999.31	114348.71	114219.21	115514.21	114694.04	1076.14	119661.41	117002.27	131184.36	122616.01
1000.85	114183.34	115255.49	114987.45	114808.76	1077.44	128159.72	142399.69	122819.73	131126.38
1002.38	112850.47	113542.8	114927.47	113773.58	1078.74	132635.79	126319.8	124515.23	127823.61
1003.92	113135.5	110849.94	111707.03	111897.49	1080.02	127804.13	136079.22	141595.94	135159.76
1005.45	112501.57	113981.86	113093.69	113192.37	1081.3	129685.61	125020.66	145546.44	133417.57
1006.99	112471.37	112777.83	111551.98	112267.06	1082.55	121517.28	115821.15	136706.94	124681.79
1008.53	114520.29	115789.21	115154.75	115154.75	1083.79	129909.18	131877.5	135814.14	132533.61
1010.06	114711.88	116030.4	113063.72	114602	1085.02	127649.86	134685.68	132675.44	131670.33
1011.6	114353.96	116408.22	116408.22	115723.47	1086.24	130480.28	130480.28	126338.05	129099.54
1013.13	115303.91	115481.57	115481.57	115422.35	1087.43	123164.21	130661.16	134945.13	129590.17
1014.67	115093.17	114908.43	114538.95	114846.85	1088.62	131574.59	132680.26	134891.6	133048.82
1016.2	116882.21	114387.19	114771.04	115346.81	1089.78	133370.5	137969.48	133370.5	134903.49
1017.74	116865.03	116865.03	113663.24	115797.77					
1019.27	115299.63	116548.36	114467.14	115438.38					

APPENDIX C-2A

TOTAL SKY RADIANCE CALCULATION

MAY 12, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0.01	0.01	0.01	0.01
115.33	0.1	0.1	0.09	0.0966667
122.58	0.11	0.1	0.1	0.1033333
129.71	0.11	0.11	0.11	0.11
136.72	0.12	0.12	0.12	0.12
143.6	0.13	0.13	0.13	0.13
150.37	0.14	0.13	0.13	0.1333333
157.02	0.14	0.14	0.14	0.14
163.55	0.15	0.15	0.14	0.1466667
169.97	0.16	0.15	0.15	0.1533333
176.28	0.17	0.16	0.16	0.1633333
182.48	0.17	0.17	0.17	0.17
188.57	0.18	0.18	0.18	0.18
194.55	0.19	0.18	0.18	0.1833333
200.43	0.2	0.19	0.19	0.1933333
206.21	0.2	0.2	0.2	0.2
211.88	0.21	0.21	0.2	0.2066667
217.46	0.22	0.21	0.21	0.2133333
222.94	0.23	0.22	0.22	0.2233333
228.33	0.23	0.23	0.23	0.23
233.62	0.24	0.24	0.23	0.2366667
238.82	0.25	0.25	0.25	0.25
243.92	0.26	0.25	0.25	0.2533333
248.94	0.27	0.26	0.26	0.2633333
253.87	0.38	0.37	0.36	0.37
258.72	0.52	0.51	0.5	0.51
263.48	0.84	0.82	0.81	0.8233333
268.16	1.27	1.23	1.22	1.24
272.75	1.85	1.78	1.77	1.8
277.27	2.57	2.48	2.43	2.4933333
281.71	5.1	4.91	4.93	4.98
286.07	10.87	10.62	10.4	10.63
290.36	17.01	16.5	16.34	16.616667
294.57	25.01	24.48	24.24	24.576667
298.71	34.55	33.27	32.89	33.57
302.78	82.73	80.21	80.21	81.05
306.78	159.76	157.11	154.18	157.01667
310.71	257.74	250.23	246.9	251.62333
314.57	394.42	381.57	381.57	385.85333
318.37	572.68	554	549.16	558.61333
322.1	1010.31	986.57	975.22	990.7
325.77	1792.46	1752.79	1736.01	1760.42
329.38	2819.03	2744.38	2720.81	2761.4067
332.93	5004.28	4870.91	4824.52	4899.9033
336.42	7766.34	7585.73	7489.66	7613.91
339.85	10597.17	10331.78	10221.97	10383.64
343.22	13165.7	12849.12	12718.47	12911.097
346.53	15935.98	15532.33	15370.87	15613.06
349.79	18637.42	18193.94	17997.46	18276.273
353	21505.93	20979.52	20778.42	21087.957
356.16	23507.55	22907.13	22670.6	23028.427
359.26	25387.75	24741.36	24488.96	24872.69
362.32	27901.02	27150.12	26821.22	27290.787
365.32	31148.18	30345.84	29978.87	30490.963
368.28	34451.62	33590.48	33212.57	33751.557
371.19	37948.46	37013.56	36530.42	37164.147
374.05	41385.07	40330.51	39880.39	40531.99
376.87	44269.47	43105	42578.69	43317.72
379.64	47241.45	45970.44	45462.04	46224.643
382.37	52819.47	51403.33	50756.53	51659.777
385.06	60969.36	59336.38	58615.94	59640.56
387.71	70250.7	68337.21	67452.47	68680.127
390.32	78908.24	76754.65	75769.57	77144.153
392.89	85941.99	83615.01	82546.77	84034.59
395.42	89806.49	87399.45	86267.12	87824.353
397.92	92386.65	89850.63	88700.33	90312.537
400.37	94919.67	92266.68	91050.45	92745.6
402.8	98783.3	96028.87	94752.43	96521.533
405.18	102588.11	99709.22	98374.28	100223.87
407.54	106021.62	102996.69	101609.41	103542.57
409.86	108842.95	105725.02	104254.17	106274.05
412.15	111145.43	107969.65	106490.8	108535.29
414.4	112558.41	109320.6	107763.17	109880.73
416.63	113304.11	110041.11	108464.22	110603.15
418.83	114225.63	110913.16	109318.27	111485.69
420.99	114555.3	111210.32	109632.63	111799.42
423.13	114801.57	111382.61	109831.6	112005.26
425.25	114503.08	111044.49	109499.87	111682.48
427.33	113637.27	110234.88	108623.57	110831.91
429.39	111730.87	108336.1	106800.21	108955.73
431.43	110070.21	106764.51	105141.11	107325.28
433.44	112305.65	108802.99	107194.36	109434.33
435.42	117930.39	114301.07	112566.71	114932.72
437.38	123424.48	119610.64	117764.21	120266.44
439.32	126473.21	122540.62	120687.76	123233.86
441.24	127889.87	123896.83	121972.41	124586.37
443.14	129168.37	125086.66	123152.24	125802.42
445.02	132213.92	127994.59	125972.57	128727.03
446.87	136139.76	131798.08	129711.81	132549.88
448.71	138016.79	133609.66	131516.11	134380.85
450.53	139068.98	134561.97	132390.3	135340.42
452.33	141349.6	136758.86	134592.58	137567.01
454.11	144365.22	139675.02	137386.5	140475.58
455.88	146229.46	141451.74	139172.18	142284.46
457.63	145370.44	140629.1	138347.6	141449.05
459.36	144312.57	139557.54	137255.55	140375.22
461.08	144836.56	140027.01	137719.85	140861.14
462.78	145660.24	140783.52	138495.39	141646.38

464.47	145074.77	140265.17	137854.7	141064.88	542.3	96993.12	93338.91	91497.57	93943.2
466.15	144717.72	139893.61	137528.96	140713.43	543.74	96902.73	93247.17	91477.74	93875.88
467.81	144696.21	139850.98	137461.4	140669.53	545.18	96586.43	92875.79	91100.54	93520.92
469.46	143289.97	138478.01	136126.84	139298.27	546.62	95997.39	92318.14	90561.62	92959.05
471.1	141011.25	136230	133902.5	137047.92	548.07	95548.83	91900.19	90132.88	92527.3
472.72	139074.92	134361.17	132040.13	135158.74	549.51	95024.77	91386.33	89642.28	92017.793
474.33	138072.33	133368.23	131063.49	134168.02	550.96	94310.45	90700.8	88950.8	91320.683
475.94	137141.52	132464.9	130185.68	133264.03	552.41	93627.2	90049.31	88297.71	90658.073
477.53	137230.35	132465.84	130182.72	133292.97	553.86	92554.2	89024.07	87326.65	89634.973
479.11	137385.52	132599.96	130326.82	133437.43	555.32	91101.13	87620.13	85932.62	88217.96
480.68	136934.45	132120.46	129841.34	132965.42	556.77	89732.82	86315.71	84653.99	86900.84
482.24	136038.26	131285.19	128936.88	132086.78	558.23	89123.7	85708.65	84046.28	86292.877
483.8	135549.06	130782.81	128505.24	131612.37	559.69	88702.96	85309.11	83649.71	85887.26
485.34	135005.39	130223.21	127932.77	131053.79	561.16	88077.56	84691.76	83032.89	85267.403
486.88	133955.98	129203.43	126935.78	130031.73	562.62	87110.32	83747.91	82142.63	84333.62
488.41	131646.91	126965.3	124707	127773.07	564.09	86195.43	82892.73	81292.64	83460.267
489.93	127155.19	122669.66	120492.13	123438.99	565.56	85131.27	81899.19	80287.7	82439.387
491.45	122344.23	117979.71	115871.17	118731.7	567.03	84142.48	80873.55	79331.95	81449.327
492.95	122306.26	117966.29	115837.33	118703.29	568.51	83738.95	80518.94	78946.71	81068.2
494.46	124540.47	120048.56	117902.96	120830.66	569.99	83747.11	80502.88	78933.4	81061.13
495.95	124474.4	120042.02	117868.81	120795.08	571.47	83440.72	80207.03	78628.68	80758.81
497.44	123316.6	118894.6	116762.82	119658.01	572.95	82948.62	79726.14	78151.14	80275.3
498.93	122939.26	118491.41	116371.76	119267.48	574.44	82613.08	79415.06	77871.52	79966.553
500.41	122296.83	117882.46	115724.54	118634.61	575.93	82395.98	79207.17	77639.14	79747.43
501.88	120478.36	116142.48	114014.6	116878.48	577.42	82197.35	79001.34	77479.43	79559.373
503.35	118153.13	113902.87	111828.58	114628.19	578.92	81643.99	78485.76	76958.34	79029.363
504.82	115676.66	111485.03	109461.31	112207.67	580.42	80511.42	77392.61	75858.62	77920.883
506.28	114289.65	110088.82	108094.85	110824.44	581.92	78815.35	75740.85	74260.36	76272.187
507.74	113761.39	109599.96	107568.6	110309.98	583.42	76197.26	73223.07	71765.05	73728.46
509.2	114206.35	109996.27	107969	110723.87	584.93	73730.31	70850.49	69476.64	71352.48
510.65	113501.38	109323.61	107301.28	110042.09	586.44	73041.79	70183.88	68807.05	70677.573
512.1	112422.2	108259.16	106263.11	108981.49	587.95	73496.3	70608.95	69214.75	71106.667
513.55	111628.29	107491.73	105519.36	108213.13	589.47	73606.48	70724.73	69345.75	71225.653
514.99	110358.87	106282.86	104304.73	106982.15	590.99	73862.23	70965.25	69565.69	71464.39
516.44	108278.65	104288.33	102300.16	104955.71	592.51	74216.83	71329.96	69914.16	71820.317
517.88	105976.56	102054.35	100168.07	102732.99	594.03	74533.74	71634	70209.78	72125.84
519.32	103041.02	99213.71	97355.36	99870.03	595.56	74635.98	71736.7	70332.3	72234.993
520.76	102202.89	98375.32	96513.62	99030.61	597.09	74740.73	71831.19	70435.31	72335.743
522.2	103643.46	99773.96	97940.13	100452.52	598.62	74844.2	71919.76	70524.21	72429.39
523.63	104634.5	100751.22	98837.41	101407.71	600.16	74711.89	71796.75	70411.6	72306.747
525.07	104707.85	100808.81	98900.04	101472.23	601.7	74285.33	71391.1	70024.76	71900.397
526.5	104073.67	100199.49	98290.59	100854.58	603.24	73601.55	70747.47	69350.89	71233.303
527.94	102525.56	98726.52	96864.42	99372.167	604.79	72857.6	70072.75	68704.08	70544.81
529.37	102522.64	98703.26	96847.36	99357.753	606.34	72259.06	69480.79	68098.88	69946.243
530.81	103183.72	99335.39	97431.77	99983.627	607.89	71691.38	68904.33	67544.79	69380.167
532.24	102907.98	99063.09	97175.59	99715.553	609.44	71090.24	68328.83	67024.15	68814.407
533.67	101798.28	97981.44	96132.28	98637.333	611	70652.13	67916.31	66563.22	68377.22
535.11	101359.05	97505.4	95672.4	98178.95	612.56	70469.86	67733.31	66422.15	68208.44
536.55	100870.38	97062.49	95226.54	97719.803	614.12	70251.35	67532.14	66212.37	67998.62
537.98	99840.58	96069.25	94239.54	96716.457	615.69	69649.32	66945.75	65663.8	67419.623
539.42	98368.2	94607.17	92838.13	95271.167	617.25	68843.66	66187.98	64865.12	66632.253
540.86	97271.48	93600.68	91794.11	94222.09	618.82	67988.02	65331.62	64055.36	65791.667

620.4	67229.41	64603.45	63371.46	65068.107	704.45	47767.41	45887.6	45043.49	46232.833
621.97	66543.93	63935.51	62679.97	64386.47	706.08	47890.78	46051.61	45122.98	46355.123
623.55	66039.94	63469.39	62193.74	63901.023	707.71	47767.11	45930.15	45045.01	46247.423
625.13	65767.02	63191.02	61953.2	63637.08	709.34	47239.1	45398.06	44501.92	45713.027
626.71	65681.6	63133.3	61894.74	63569.88	710.97	45571.87	43829.26	42988.63	44129.92
628.3	65651.02	63121.98	61864.55	63545.85	712.6	41981.08	40352.18	39568.59	40633.95
629.89	65476.17	62907.74	61656.57	63346.827	714.23	36907.73	35510.08	34829.81	35749.207
631.47	65232.75	62712.26	61449.62	63131.543	715.86	33264.13	31970.87	31386.42	32207.14
633.07	65056.32	62512.3	61288.65	62952.423	717.49	33309.13	31965.57	31349.77	32208.157
634.66	64662.27	62135.44	60918.64	62572.117	719.11	34909.13	33550.16	32908.09	33789.127
636.26	64114.35	61591.72	60399.66	62035.243	720.74	35019.26	33717.18	33056.79	33931.077
637.86	63455.79	60983.94	59772.93	61404.22	722.36	33765.7	32435.8	31842.65	32681.383
639.46	62412.57	59997.96	58825.87	60412.133	723.99	33156.14	31876.58	31296.1	32109.607
641.06	61038.24	58683.77	57519.25	59080.42	725.61	33229.33	31926.95	31325.86	32160.713
642.66	59937.48	57562.9	56477.97	57992.783	727.23	33731.84	32426.01	31804.48	32654.11
644.27	59501.5	57159.2	56039.65	57566.783	728.85	35195.87	33808.22	33209	34071.03
645.88	59190.14	56877.94	55768.71	57278.93	730.47	37519.48	36101.02	35410.79	36343.763
647.49	58751.76	56461.98	55332.85	56848.863	732.08	39639.85	38137.04	37430.21	38402.367
649.1	57752.56	55507.12	54413.47	55891.05	733.7	40674.43	39116.69	38392.3	39394.473
650.71	56838.51	54609.96	53533.19	54993.887	735.32	41214.01	39640.26	38879.19	39911.153
652.32	57218.79	54954.36	53879.17	55350.773	736.93	41818.24	40233.08	39485.98	40512.433
653.94	58388.75	56140.9	55047.35	56525.667	738.54	42484.43	40878.15	40143.85	41168.81
655.56	59284.37	56946.12	55844.11	57358.2	740.15	43248.65	41543.03	40762.94	41851.54
657.18	59550.99	57208.88	56114.38	57624.75	741.76	43793.08	42100.02	41366.8	42419.967
658.8	59428.58	57113.4	55992.97	57511.65	743.37	44185.69	42515.51	41687.16	42796.12
660.42	59221.1	56924.77	55814.02	57319.963	744.97	44255.08	42581.99	41813.46	42883.51
662.04	58957.16	56649.29	55550.03	57052.16	746.58	44144.85	42447.76	41698.85	42763.82
663.66	58687.75	56372.18	55288.54	56782.823	748.18	43819.8	42193.5	41422.05	42478.45
665.29	58435.47	56158.76	55031.73	56541.987	749.78	43568.41	41975.04	41118.7	42220.717
666.92	58204.28	55901.4	54834.62	56313.433	751.38	43370.62	41726.5	40996.57	42031.23
668.54	57988.86	55701.25	54591.41	56093.84	752.98	43156.49	41519.82	40780.45	41818.92
670.17	57745.39	55496.38	54403.19	55881.653	754.57	42523.23	40949.91	40217.62	41230.253
671.8	57463.14	55265.54	54123.92	55617.533	756.16	40025.66	38576.04	37865.87	38822.523
673.43	57162.15	54882.08	53856.62	55300.283	757.76	33626.84	32433.82	31833.61	32631.423
675.06	56779.56	54560.67	53494.22	54944.817	759.35	25778.3	24862.48	24344.51	24995.097
676.69	56239.32	54059.9	52978.82	54426.013	760.93	21767.6	20950.75	20557.45	21091.933
678.32	55400.66	53184.87	52131.64	53572.39	762.52	22795.6	21902.4	21528.33	22075.443
679.95	53675.42	51576.15	50561.12	51937.563	764.1	26386.1	25380.11	24911.67	25559.293
681.58	50729.66	48752.28	47792.49	49091.477	765.69	31301.42	30106.71	29544.04	30317.39
683.22	47807.9	45941.72	45043.4	46264.34	767.27	35630.44	34266.29	33653.98	34516.903
684.85	46945.84	45082.87	44165.89	45398.2	768.85	38275.89	36835.77	36174.1	37095.253
686.48	47306.7	45436.11	44585.31	45776.04	770.42	39504.32	37989.73	37318.31	38270.787
688.12	47136.99	45302	44425.41	45621.467	772	39971.24	38465.55	37767.6	38734.797
689.75	46712.33	44838.68	43966.26	45172.423	773.57	40090.04	38562.35	37885.12	38845.837
691.38	46923.69	45096.33	44197.34	45405.787	775.14	40034.72	38535.89	37865.35	38811.987
693.02	47644.71	45799.98	44874.67	46106.453	776.7	39898.96	38393.64	37720.21	38670.937
694.65	47490.04	45590.2	44734.69	45938.31	778.27	39752.73	38259.82	37553.07	38521.873
696.29	46567.96	44732.48	43844.34	45048.26	779.83	39553.25	38047.6	37386.39	38329.08
697.92	46101.74	44318.11	43441.11	44620.32	781.4	39358.12	37906.03	37148.07	38137.407
699.55	46501.17	44701.01	43827.66	45009.947	782.96	39026.79	37544.56	36903.59	37824.98
701.19	47146.64	45274.09	44400.23	45606.987	784.51	38492.22	37078.48	36403.74	37324.813
702.82	47498.45	45657.1	44766.32	45973.957	786.07	37777.12	36335	35722.71	36611.61

787.62	36786.91	35419.93	34797.11	35667.983	865.69	27255.29	26244.37	25758.61	26419.423
789.17	35878.08	34536.61	33943.12	34785.937	867.15	27417.32	26370.36	25925.4	26571.027
790.72	35327.99	34044.67	33431.62	34268.093	868.62	27819.12	26765.17	26231.69	26938.66
792.27	35185.96	33877.9	33293.8	34119.22	870.08	27915.47	26838.8	26371.82	27042.03
793.81	35122.28	33772.38	33192.67	34029.11	871.54	27747.89	26728.31	26302.42	26926.207
795.35	34820.8	33510.11	32925.73	33752.213	873	27593.87	26560.87	26121.85	26758.863
796.89	34566.26	33238.72	32650.58	33485.187	874.46	27424.96	26457.93	25980.87	26621.253
798.43	34372.75	33088.98	32510.85	33324.193	875.91	27342.54	26360.02	25829.97	26510.843
799.97	33933.68	32682.59	32091.32	32902.53	877.37	27142.47	26093.55	25614.42	26283.48
801.5	33462.78	32216.36	31619.12	32432.753	878.83	26753.11	25790.68	25348.48	25964.09
803.03	33258.33	31989.93	31447.58	32231.947	880.29	26636.12	25640.86	25208.71	25828.563
804.56	33396.36	32166.99	31592.11	32385.153	881.74	26542.14	25565.93	25143.79	25750.62
806.09	33639.85	32371.44	31799.76	32603.683	883.2	26316.96	25331.91	24959.18	25536.017
807.61	33339.37	32080.42	31491.71	32303.833	884.66	26038.24	25029	24504.2	25190.48
809.14	32414.41	31180.01	30622.25	31405.557	886.11	25711.98	24814.11	24419.58	24981.89
810.66	30924.69	29748.1	29182.97	29951.92	887.57	25720.04	24713.84	24217.63	24883.837
812.17	28641.94	27586.32	27072.52	27766.927	889.03	25240.02	24261.72	23786.55	24429.43
813.69	25936.22	24943.04	24545.76	25141.673	890.48	24165.46	23256.77	22830.82	23417.683
815.21	23630.76	22693.19	22281.8	22868.583	891.94	22424.87	21515.75	21140.56	21693.727
816.72	22485.1	21654.11	21267.6	21802.27	893.39	20122.25	19459.37	19061.63	19547.75
818.23	22724.06	21844.79	21454.01	22007.62	894.85	17996.5	17322.19	17022.5	17447.063
819.74	23835.56	22848.17	22453.22	23045.65	896.31	16382.5	15785.94	15541.19	15903.21
821.25	24033.69	23095.11	22755.62	23294.807	897.76	15339.33	14776.42	14635.69	14917.147
822.75	23625.96	22688.18	22244.5	22852.88	899.22	15282.48	14691	14355.3	14776.26
824.25	24241.91	23324.04	22885.5	23483.817	900.68	16240.28	15636.37	15391.54	15756.063
825.75	25389.42	24420.43	23997.79	24602.547	902.14	17655.27	17054.52	16704.09	17137.96
827.25	25305.85	24306.52	23838.09	24483.487	903.59	17713.96	17047.12	16773.54	17178.207
828.75	24910.22	23939.56	23528.08	24125.953	905.05	16251.29	15639.68	15325.14	15738.703
830.25	24981.81	24075.51	23649.02	24235.447	906.51	15040.15	14448.58	14143.83	14544.187
831.74	25357.4	24409.46	23967.81	24578.223	907.97	14555.46	14022.49	13820.33	14132.76
833.23	25926.92	24934.35	24508.96	25123.41	909.43	14510.85	13965.75	13646.21	14040.937
834.72	26784.43	25802.22	25283.53	25956.727	910.89	13974.75	13435.78	13185.54	13532.023
836.21	27628.47	26558.55	26101.6	26762.873	912.35	13426.19	13011.56	12695.65	13044.467
837.7	28313.06	27229.74	26767.07	27436.623	913.82	13362.66	12756.18	12695.53	12938.123
839.18	28837.62	27730.67	27217.14	27928.477	915.28	13826.97	13246.53	12997.77	13357.09
840.67	29221.57	28102.99	27618.65	28314.403	916.74	14921.97	14305.54	14071.72	14433.077
842.15	29481.94	28326.02	27788.92	28532.293	918.21	16078.47	15425.76	15099.4	15534.543
843.63	29619.04	28473.03	28047.71	28713.26	919.68	16217.59	15503.75	15347.6	15689.647
845.11	29840.54	28660.27	28231.08	28910.63	921.14	15890.66	15113.28	14861.77	15288.57
846.59	29855.04	28708.16	28213.19	28925.463	922.61	15326.53	14671.35	14460.76	14819.547
848.07	29402.43	28326.13	27800.22	28509.593	924.08	14512.15	13865.57	13697.94	14025.22
849.54	28973.06	27808.69	27337.98	28039.91	925.55	12559.63	12141.79	11871.43	12190.95
851.02	28463.7	27384.86	26920.71	27589.757	927.02	10128.98	9625.05	9499.06	9751.03
852.49	27852.65	26744.66	26324.38	26973.897	928.49	7812.85	7554.15	7424.79	7597.2633
853.96	27447.66	26432.03	25866.37	26582.02	929.97	6069.75	5936.64	5723.67	5910.02
855.43	27920.44	26919.1	26398.93	27079.49	931.44	4932.62	4631.18	4740.8	4768.2
856.9	28742.51	27561.85	27128.94	27811.1	932.92	4551.33	4410.85	4326.57	4429.5833
858.37	28865.37	27809.97	27348.23	28007.857	934.4	4540.68	4454.47	4396.99	4464.0467
859.83	28904.62	27833.59	27410.46	28049.557	935.88	5175.61	4970.93	4941.69	5029.41
861.3	28879.87	27860.27	27304.12	28014.753	937.36	6147.96	5821.26	5732.16	5900.46
862.76	28599.36	27568.51	27026.66	27731.51	938.84	6155.55	5974.5	5793.46	5974.5033
864.23	27846.06	26724.3	26315.18	26961.847	940.32	5776.86	5622.4	5498.83	5632.6967

941.81	5610.91	5390.26	5201.12	5400.7633	1020.8	20063.06	18978.57	19087.02	19376.217
943.29	5502.3	5212.71	5116.17	5277.06	1022.33	19597.38	18691.14	18917.7	19068.74
944.78	5599.76	5272.29	5206.79	5359.6133	1023.86	20149.75	19442.74	18853.57	19482.02
946.27	5768.33	5634.96	5434.9	5612.73	1025.39	20349.65	18869.68	19116.34	19445.223
947.76	5861.61	5692.2	5455.02	5669.61	1026.91	20275.89	19120.93	18992.6	19463.14
949.25	6003.13	5727.12	5761.62	5830.6233	1028.44	19689.2	19153.44	18751.62	19198.087
950.74	6065.75	5715.13	5750.19	5843.69	1029.96	20885.98	19203.89	19063.71	19717.86
952.24	6157.58	6157.58	5872.84	6062.6667	1031.48	20502.7	19331.12	19184.67	19672.83
953.74	6399.17	6326.86	6109.94	6278.6567	1033	20664.49	19746.07	19746.07	20052.21
955.23	7021.12	6653.52	6506.48	6727.04	1034.51	20915.04	20116.76	19478.13	20169.977
956.73	6962.73	6702.09	6590.39	6751.7367	1036.02	20873.76	19203.86	19203.86	19760.493
958.24	7257.99	7068.98	6917.77	7081.58	1037.53	20908.43	20037.25	19688.77	20211.483
959.74	8094.88	7557.78	7442.68	7698.4467	1039.03	20602.78	19873.48	20238.13	20238.13
961.24	8559.89	8170.8	8092.99	8274.56	1040.54	21032.89	19694.43	20459.27	20395.53
962.75	9117.03	8722.35	8485.55	8774.9767	1042.03	21304.98	20309.42	20110.31	20574.903
964.26	9907.14	9666.49	9385.72	9653.1167	1043.53	21047.48	20630.69	20630.69	20769.62
965.77	11733.54	11246.33	11165.13	11381.667	1045.02	22052.18	20742.15	19868.79	20887.707
967.28	13041.67	12422.6	12174.98	12546.417	1046.5	22536.91	20943.39	19805.16	21095.153
968.79	13770.02	13142.21	12765.52	13225.917	1047.98	21137.1	21612.09	20899.61	21216.267
970.3	13359.78	12976.86	12849.22	13061.953	1049.46	22590.68	21349.43	20604.68	21514.93
971.82	12825.13	12305.19	12131.88	12420.733	1050.93	23047.26	21493.51	20975.6	21838.79
973.34	12664.78	12091.11	12002.86	12252.917	1052.39	22938.82	21859.35	21589.48	22129.217
974.85	13049.18	12466.23	12152.33	12555.913	1053.85	23525.88	21825.21	22108.66	22486.583
976.37	13361.4	12814.17	12677.37	12950.98	1055.3	23912.43	22731.57	21550.71	22731.57
977.9	13853.66	13528.24	13063.35	13481.75	1056.75	25441.4	22989.22	21456.61	23295.743
979.42	14741.05	14172.26	13745.67	14219.66	1058.19	23788.33	21859.55	23466.87	23038.25
980.94	15590.78	14770.21	14577.14	14979.377	1059.62	23946.84	20953.48	21286.08	22062.133
982.47	15996.24	15454.83	15208.74	15553.27	1061.05	24474.4	23425.5	22726.23	23542.043
983.99	16979.22	16175.47	15823.83	16326.173	1062.46	24500.2	22671.83	24134.53	23768.853
985.52	17598	16725.8	16520.57	16948.123	1063.87	25575.79	22903.7	22140.24	23539.91
987.05	17796.3	17218.84	16798.87	17271.337	1065.27	25446.09	24253.31	23458.12	24385.84
988.58	18272.8	17574.13	17036.7	17627.877	1066.67	26090.49	24459.83	23236.84	24595.72
990.11	18475.99	18201.05	17541.19	18072.743	1068.05	23788.68	23788.68	25040.72	24206.027
991.64	18600.86	17978.94	17809.33	18129.71	1069.42	24368.3	25650.84	23513.27	24510.803
993.17	19117.31	17958.69	18016.62	18364.207	1070.79	25988.17	21656.81	22523.08	23389.353
994.71	19101.53	18625.48	17911.4	18546.137	1072.14	27085.81	24901.47	26212.08	26066.453
996.24	19078.91	18467.41	18100.51	18548.943	1073.48	25999.66	24677.64	23355.63	24677.643
997.77	19294.45	18537.81	18159.48	18663.913	1074.82	24718.59	23835.79	22952.98	23835.787
999.31	18971.78	18194.78	18130.03	18432.197	1076.14	25705.04	24818.66	24818.66	25114.12
1000.85	18896.54	18494.49	17891.4	18427.477	1077.44	26699.94	24474.95	24474.95	25216.613
1002.38	18900.72	18277.62	18069.92	18416.087	1078.74	26617.39	23459.39	25263.96	25113.58
1003.92	18641.65	18213.1	17784.56	18213.103	1080.02	26204.44	24365.54	25744.72	25438.233
1005.45	18947.63	18133.48	17911.43	18330.847	1081.3	26123.72	24257.74	23791.25	24724.237
1006.99	19077.23	18157.84	18234.46	18489.843	1082.55	27531.26	25157.87	24208.52	25632.55
1008.53	19113.15	18399.38	18002.84	18505.123	1083.79	27064.41	24604.01	25588.17	25752.197
1010.06	19201.05	18624.2	18212.16	18679.137	1085.02	27640.72	25630.48	24625.37	25965.523
1011.6	19258.71	18402.77	18231.58	18631.02	1086.24	27442.28	25371.17	27960.06	26924.503
1013.13	19809.53	18743.55	18121.72	18891.6	1087.43	29452.31	26239.33	24632.84	26774.827
1014.67	19397.72	18474.02	18381.65	18751.13	1088.62	28194.56	25983.22	26536.05	26904.61
1016.2	19384.41	18712.67	18520.74	18872.607	1089.78	28743.64	25294.4	24144.66	26060.9
1017.74	19610.91	19110.63	18810.47	19177.337					
1019.27	19875.66	19043.17	18106.62	19008.483					

APPENDIX C-2B

TOTAL WATER RADIANCE CALCULATION

MAY 12, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0	0	0	0
115.33	0	0	0	0
122.58	0	0.01	0	0.0033333
129.71	0	0.01	0.01	0.0066667
136.72	0.01	0.01	0.01	0.01
143.6	0.01	0.01	0.01	0.01
150.37	0.01	0.01	0.01	0.01
157.02	0.01	0.01	0.01	0.01
163.55	0.01	0.01	0.01	0.01
169.97	0.01	0.01	0.01	0.01
176.28	0.01	0.01	0.01	0.01
182.48	0.01	0.01	0.01	0.01
188.57	0.01	0.01	0.01	0.01
194.55	0.01	0.01	0.01	0.01
200.43	0.01	0.01	0.01	0.01
206.21	0.01	0.01	0.01	0.01
211.88	0.01	0.01	0.01	0.01
217.46	0.01	0.01	0.01	0.01
222.94	0.01	0.01	0.01	0.01
228.33	0.01	0.01	0.01	0.01
233.62	0.01	0.01	0.01	0.01
238.82	0.01	0.01	0.01	0.01
243.92	0.01	0.01	0.01	0.01
248.94	0.01	0.01	0.01	0.01
253.87	0.02	0.02	0.02	0.02
258.72	0.02	0.02	0.02	0.02
263.48	0.04	0.04	0.04	0.04
268.16	0.06	0.06	0.06	0.06
272.75	0.08	0.08	0.08	0.08
277.27	0.11	0.11	0.12	0.1133333
281.71	0.21	0.23	0.23	0.2233333
286.07	0.48	0.5	0.49	0.49
290.36	0.74	0.76	0.75	0.75
294.57	1.09	1.09	1.06	1.08
298.71	1.41	1.43	1.51	1.45
302.78	3.32	3.57	3.32	3.4033333
306.78	6.17	6.31	6.75	6.41
310.71	9.7	9.91	10.11	9.9066667
314.57	14.53	14.66	14.66	14.616667
318.37	20.06	20.23	20.23	20.173333
322.1	32.77	36.12	35.6	34.83
325.77	58.73	60.26	61.02	60.003333
329.38	88.89	90.86	92.82	90.856667
332.93	152.94	159.46	160.19	157.53
336.42	231.53	243.06	244.98	239.85667
339.85	313.43	326.01	329.45	322.96333
343.22	384.42	402.01	405.77	397.4
346.53	458.81	478.99	487.07	474.95667
349.79	538.91	558.56	568.39	555.28667
353	622.52	649.14	656.53	642.73
356.16	677.75	705.04	717.17	699.98667
359.26	735.65	767.97	774.13	759.25
362.32	806.75	847.08	848.64	834.15667
365.32	903.41	945.39	953.17	933.99
368.28	1002.08	1045.44	1050.09	1032.5367
371.19	1094.91	1156.09	1157.65	1136.2167
374.05	1196.03	1257.11	1266.76	1239.9667
376.87	1289.47	1340.45	1353.61	1327.8433
379.64	1391.42	1441.59	1461.66	1431.5567
382.37	1555.72	1634.01	1635.72	1608.4833
385.06	1802.8	1892	1888.57	1861.1233
387.71	2079.81	2165.54	2180.97	2142.1067
390.32	2330.22	2442.32	2447.41	2406.65
392.89	2554.92	2668.89	2679.1	2634.3033
395.42	2678.26	2800.31	2810.48	2763.0167
397.92	2766.42	2904.32	2912.73	2861.1567
400.37	2868.51	3000.49	3013.85	2960.95
402.8	3004.68	3144.08	3155.84	3101.5333
405.18	3133.4	3281.73	3298.58	3237.9033
407.54	3268.55	3410.67	3422.51	3367.2433
409.86	3373.81	3524.62	3538.18	3478.87
412.15	3468.82	3625.57	3635.79	3576.7267
414.4	3531.54	3698.89	3710.85	3647.0933
416.63	3595.79	3747.68	3764.74	3702.7367
418.83	3656.67	3818.54	3820.24	3765.15
420.99	3693.69	3861.28	3869.75	3808.24
423.13	3732.53	3897.75	3912.92	3847.7333
425.25	3762.48	3923.66	3938.77	3874.97
427.33	3770.26	3928.4	3941.72	3880.1267
429.39	3749.08	3907.28	3920.47	3858.9433
431.43	3734.47	3893.21	3912.84	3846.84
433.44	3851.3	4018.33	4028.06	3965.8967
435.42	4090.21	4254.01	4257.22	4200.48
437.38	4305.69	4477.6	4499.88	4427.7233
439.32	4441.5	4624.26	4641.59	4569.1167
441.24	4528.99	4720.18	4731.15	4660.1067
443.14	4627.91	4817.29	4832.94	4759.38
445.02	4787.43	4983.06	5000.28	4923.59
446.87	4976.02	5182.77	5196.87	5118.5533
448.71	5095.55	5301.45	5320.31	5239.1033
450.53	5193.13	5404.01	5426.04	5341.06
452.33	5335.4	5563.68	5581	5493.36
454.11	5515.39	5730.72	5759.02	5668.3767
455.88	5648.95	5870.66	5897.21	5805.6067
457.63	5674.55	5906.69	5931.29	5837.51
459.36	5703.62	5937.75	5961.92	5867.7633
461.08	5793.05	6023.76	6047.43	5954.7467
462.78	5877.78	6117.57	6153.68	6049.6767

464.47	5920.06	6159.13	6190.25	6089.8133	542.3	6855.2	7272.82	7492.31	7206.7767
466.15	5967.4	6222.54	6249.03	6146.3233	543.74	6900.28	7333.3	7556.23	7263.27
467.81	6026.26	6275.4	6311.19	6204.2833	545.18	6932.86	7367.52	7595.14	7298.5067
469.46	6036.87	6283.49	6325.97	6215.4433	546.62	6945.2	7385.45	7619.05	7316.5667
471.1	6004.01	6255.15	6293.58	6184.2467	548.07	6953.03	7409.11	7647.02	7336.3867
472.72	5999.69	6243.65	6293.27	6178.87	549.51	6972.96	7422.94	7675.31	7357.07
474.33	6027.65	6279.56	6322.7	6209.97	550.96	6970.5	7430.14	7678.93	7359.8567
475.94	6063.85	6324.13	6370.56	6252.8467	552.41	6967.98	7431.82	7691.24	7363.68
477.53	6146.84	6408.86	6452.77	6336.1567	553.86	6944.43	7403.64	7671.17	7339.7467
479.11	6231.2	6491.84	6544.54	6422.5267	555.32	6879.46	7350.25	7610.1	7279.9367
480.68	6276.09	6548.9	6600.06	6475.0167	556.77	6832.19	7299.55	7560.21	7230.65
482.24	6316.73	6580.63	6641.31	6512.89	558.23	6828.04	7291.86	7567.9	7229.2667
483.8	6361.93	6631.35	6688.29	6560.5233	559.69	6831.48	7305.75	7580.92	7239.3833
485.34	6392.56	6679.54	6733.95	6602.0167	561.16	6822.64	7294.78	7571.26	7229.56
486.88	6409.57	6689.06	6751.31	6616.6467	562.62	6781.22	7254.13	7537.23	7190.86
488.41	6350.84	6635.71	6696.29	6560.9467	564.09	6740.22	7209.32	7497.92	7149.1533
489.93	6193.94	6468.64	6531.36	6397.98	565.56	6688.37	7157.25	7442.9	7096.1733
491.45	6025.79	6298.57	6367.38	6230.58	567.03	6634.21	7093.91	7381.8	7036.64
492.95	6092.38	6362.73	6429.1	6294.7367	568.51	6618.24	7085.66	7361.86	7021.92
494.46	6248.05	6529.99	6605.25	6461.0967	569.99	6624.84	7092.57	7376.08	7031.1633
495.95	6278.41	6568.57	6644.99	6497.3233	571.47	6605.72	7064.07	7341.96	7003.9167
497.44	6276.5	6571.78	6651	6499.76	572.95	6556.08	7006.6	7285.6	6949.4267
498.93	6320.12	6614.79	6697.25	6544.0533	574.44	6525.07	6967.63	7240.16	6910.9533
500.41	6353.05	6644.96	6739.8	6579.27	575.93	6483.11	6924.27	7191.61	6866.33
501.88	6319.82	6620.23	6711.6	6550.55	577.42	6443.14	6874.75	7142.27	6820.0533
503.35	6277.52	6573.67	6671.53	6507.5733	578.92	6364.63	6779.38	7044.92	6729.6433
504.82	6211.49	6520.46	6615.72	6449.2233	580.42	6237.61	6645.37	6897.18	6593.3867
506.28	6222.06	6529.72	6614.1	6455.2933	581.92	6071.8	6460.09	6701.92	6411.27
507.74	6279.81	6586.34	6682.45	6516.2	583.42	5827.61	6195.47	6430.28	6151.12
509.2	6365.68	6683.25	6786.95	6611.96	584.93	5607.71	5950.08	6164.74	5907.51
510.65	6394.66	6710.81	6817.05	6640.84	586.44	5503	5840.69	6044.83	5796.1733
512.1	6399.17	6717.18	6836.59	6650.98	587.95	5467.04	5783.32	5988.79	5746.3833
513.55	6417.58	6745.9	6860.26	6674.58	589.47	5381.41	5698.41	5894.79	5658.2033
514.99	6406.19	6730.69	6852.83	6663.2367	590.99	5303.68	5608.9	5788.63	5567.07
516.44	6352.15	6682.73	6804.96	6613.28	592.51	5211.46	5509.08	5678.08	5466.2067
517.88	6291.39	6620.13	6747.1	6552.8733	594.03	5113.05	5400.67	5564.26	5359.3267
519.32	6193.39	6523.03	6645.81	6454.0767	595.56	5013.43	5293.45	5449.61	5252.1633
520.76	6230.64	6552.86	6688.47	6490.6567	597.09	4933.57	5204.02	5349.06	5162.2167
522.2	6387.26	6728.69	6866.12	6660.69	598.62	4872.21	5143.32	5282.2	5099.2433
523.63	6500.32	6858.89	7000.18	6786.4633	600.16	4818.59	5074.34	5220.33	5037.7533
525.07	6570.25	6940.2	7089.26	6866.57	601.7	4761.41	5019.9	5154.92	4978.7433
526.5	6596.52	6964.2	7124.72	6895.1467	603.24	4697.05	4953.64	5086.03	4912.24
527.94	6572.38	6942.16	7106.13	6873.5567	604.79	4639.44	4892.5	5022	4851.3133
529.37	6640.21	7024.62	7190.48	6951.77	606.34	4589.92	4836.69	4966.7	4797.77
530.81	6752.84	7146.58	7321.19	7073.5367	607.89	4545.96	4788.73	4916.19	4750.2933
532.24	6791.48	7188.78	7371.71	7117.3233	609.44	4497.71	4744.17	4870.47	4704.1167
533.67	6787.34	7183.25	7374.09	7114.8933	611	4469.15	4712.36	4828.41	4669.9733
535.11	6820.86	7227.39	7419.83	7156.0267	612.56	4451.24	4697.08	4820	4656.1067
536.55	6856.88	7262.44	7462.8	7194.04	614.12	4436.15	4672.72	4800.96	4636.61
537.98	6849.23	7259.21	7461.16	7189.8667	615.69	4398.29	4630.24	4757.43	4595.32
539.42	6812.01	7225.19	7431.17	7156.1233	617.25	4345.31	4586.51	4707.11	4546.31
540.86	6804.68	7222.69	7437.7	7155.0233	618.82	4293.77	4528.74	4644.99	4489.1667

620.4	4259.2	4483.76	4596.65	4446.5367	704.45	2390.17	2482.96	2508.4	2460.51
621.97	4215.57	4436.99	4555	4402.52	706.08	2333.64	2419.56	2436.15	2396.45
623.55	4183.16	4408.2	4526.14	4372.5	707.71	2249.22	2341.67	2355.31	2315.4
625.13	4175.85	4393.31	4510.4	4359.8533	709.34	2161.09	2255.58	2260.15	2225.6067
626.71	4173.61	4390.72	4498.67	4354.3333	710.97	2024.87	2107.71	2113.84	2082.14
628.3	4169.37	4386.82	4501.45	4352.5467	712.6	1823.25	1891.12	1903.46	1872.61
629.89	4159.54	4377.9	4488.86	4342.1	714.23	1578.54	1635.74	1648.11	1620.7967
631.47	4148.81	4358.46	4472.81	4326.6933	715.86	1400.51	1456.47	1450.25	1435.7433
633.07	4130.41	4349.26	4464.13	4314.6	717.49	1368.44	1413.54	1411.98	1397.9867
634.66	4112.84	4322.59	4441.57	4292.3333	719.11	1385.46	1436.88	1435.33	1419.2233
636.26	4086.91	4292.18	4403.47	4260.8533	720.74	1350.37	1406.44	1404.88	1387.23
637.86	4040.43	4241.02	4363.11	4214.8533	722.36	1273.71	1331.46	1333.02	1312.73
639.46	3990.39	4184.06	4292.22	4155.5567	723.99	1226.5	1273.32	1268.63	1256.15
641.06	3899.11	4088.54	4192.79	4060.1467	725.61	1200.63	1247.59	1241.33	1229.85
642.66	3830.53	4013.49	4115.84	3986.62	727.23	1177.13	1236.77	1232.06	1215.32
644.27	3783.01	3967.45	4061.61	3937.3567	728.85	1190.54	1248.89	1245.73	1228.3867
645.88	3733.88	3916.15	4005.98	3885.3367	730.47	1237.98	1296.56	1293.39	1275.9767
647.49	3674.94	3849.56	3933.59	3819.3633	732.08	1271.98	1340.43	1335.66	1316.0233
649.1	3571.56	3734.02	3815.92	3707.1667	733.7	1277.29	1341.39	1342.99	1320.5567
650.71	3460.67	3624.06	3699.06	3594.5967	735.32	1273.83	1356.06	1346.39	1325.4267
652.32	3433.29	3592.13	3658.65	3561.3567	736.93	1279.82	1359.4	1349.66	1329.6267
653.94	3442.19	3602.35	3672.77	3572.4367	738.54	1289.94	1370.25	1357.14	1339.11
655.56	3445.86	3608.08	3671.01	3574.9833	740.15	1312.27	1391.6	1386.64	1363.5033
657.18	3418.19	3579.81	3636.52	3544.84	741.76	1318.13	1399.78	1403.11	1373.6733
658.8	3382.73	3539.93	3602.81	3508.49	743.37	1328.4	1417.63	1397.43	1381.1533
660.42	3350.97	3513.56	3568.23	3477.5867	744.97	1324.52	1412.94	1407.84	1381.7667
662.04	3335.19	3487.7	3542.38	3455.09	746.58	1329.5	1405.08	1406.8	1380.46
663.66	3322.22	3479.06	3521.84	3441.04	748.18	1315.29	1393.48	1391.74	1366.8367
665.29	3320.2	3470.28	3518.42	3436.3	749.78	1303.82	1391.56	1389.81	1361.73
666.92	3321.69	3481.14	3527.7	3443.51	751.38	1298.64	1385.45	1369.51	1351.2
668.54	3339.41	3488.05	3537.6	3455.02	752.98	1288.52	1371.07	1372.87	1344.1533
670.17	3356.43	3511.58	3561.4	3476.47	754.57	1274.25	1363.06	1357.63	1331.6467
671.8	3377.75	3533.3	3568.97	3493.34	756.16	1198.87	1273.91	1273.91	1248.8967
673.43	3385.73	3546.14	3590.54	3507.47	757.76	1017.03	1078.16	1076.31	1057.1667
675.06	3392.84	3551.95	3602.12	3515.6367	759.35	793.84	842.64	848.27	828.25
676.69	3385.57	3549.46	3594.03	3509.6867	760.93	697.73	720.42	726.09	714.74667
678.32	3359.67	3509.3	3566.86	3478.61	762.52	730.97	763.42	767.23	753.87333
679.95	3267.12	3430.05	3481.95	3393.04	764.1	835.12	867.76	863.92	855.6
681.58	3125.07	3262.39	3315.87	3234.4433	765.69	963.48	1023.21	1015.5	1000.73
683.22	2968.8	3100.65	3148.46	3072.6367	767.27	1098.68	1156.81	1141.31	1132.2667
684.85	2913.44	3041.12	3084.65	3013.07	768.85	1167.66	1233.83	1231.88	1211.1233
686.48	2904.95	3030.24	3081.23	3005.4733	770.42	1194.5	1270.62	1270.62	1245.2467
688.12	2873.74	2997.93	3040.29	2970.6533	772	1215.53	1295.91	1286.11	1265.85
689.75	2813.4	2933.43	2980.27	2909.0333	773.57	1216.64	1299.32	1281.61	1265.8567
691.38	2786.57	2899.68	2943.75	2876.6667	775.14	1218.79	1301.62	1293.73	1271.38
693.02	2771.51	2895.28	2927.7	2864.83	776.7	1218.12	1297.35	1295.37	1270.28
694.65	2721.43	2830.58	2871.88	2807.9633	778.27	1211.01	1298.36	1290.42	1266.5967
696.29	2622.96	2723.62	2760.62	2702.4	779.83	1210.9	1284.58	1286.58	1260.6867
697.92	2551	2651.74	2679.89	2627.5433	781.4	1210.74	1286.54	1286.54	1261.2733
699.55	2517.55	2618.55	2637.86	2591.32	782.96	1203.81	1275.92	1271.92	1250.55
701.19	2480.39	2587.39	2609.68	2559.1533	784.51	1196.86	1265.13	1273.17	1245.0533
702.82	2449.65	2534.85	2563.24	2515.9133	786.07	1170.21	1248.76	1246.75	1221.9067

787.62	1152.62	1221.38	1225.42	1199.8067	865.69	846.8	882.91	889.47	873.06
789.17	1126.02	1191.06	1191.06	1169.38	867.15	847.39	889.92	903	880.10333
790.72	1113.71	1189.32	1183.19	1162.0733	868.62	875.04	917.33	917.33	903.23333
792.27	1110.62	1182.6	1184.66	1159.2933	870.08	859.39	930.73	904.79	898.30333
793.81	1124.23	1190.48	1175.99	1163.5667	871.54	864.7	909.87	916.33	896.96667
795.35	1110.33	1181.29	1170.85	1154.1567	873	858.68	916.78	910.33	895.26333
796.89	1113.28	1178.4	1180.5	1157.3933	874.46	857.43	915.45	912.23	895.03667
798.43	1111.61	1175.37	1166.87	1151.2833	875.91	843.55	914.65	895.26	884.48667
799.97	1101.13	1161.11	1161.11	1141.1167	877.37	854.68	900	896.76	883.81333
801.5	1081.96	1142.55	1144.71	1123.0733	878.83	832.38	903.91	884.4	873.56333
803.03	1093.45	1145.93	1139.37	1126.25	880.29	828.29	890.49	880.67	866.48333
804.56	1094.49	1149.77	1151.98	1132.08	881.74	850.88	877.26	883.86	870.66667
806.09	1105.4	1156.76	1161.23	1141.13	883.2	821.99	881.89	868.58	857.48667
807.61	1095.92	1168.37	1145.73	1136.6733	884.66	824.21	871.31	851.12	848.88
809.14	1062.95	1120.1	1124.67	1102.5733	886.11	806.05	863.87	870.67	846.86333
810.66	1016.77	1065.41	1070.04	1050.74	887.57	820.12	854.58	847.69	840.79667
812.17	938.85	1004.24	980.89	974.66	889.03	800.11	849.02	831.55	826.89333
813.69	863.12	905.69	896.23	888.34667	890.48	756.06	819.95	795.1	790.37
815.21	779.72	827.56	834.73	814.00333	891.94	696.27	753.99	728.74	726.33333
816.72	751.27	787.51	785.09	774.62333	893.39	633.42	670.25	677.62	660.43
818.23	757.14	791.34	788.89	779.12333	894.85	584.4	606.88	576.91	589.39667
819.74	794.85	829.41	826.94	817.06667	896.31	523.9	543.02	546.85	537.92333
821.25	796.3	828.75	826.25	817.1	897.76	496.46	512.09	512.09	506.88
822.75	766.36	814.25	801.65	794.08667	899.22	483.57	507.55	503.55	498.22333
824.25	792.94	831.18	823.53	815.88333	900.68	542.7	554.94	534.54	544.06
825.75	816.94	858.17	860.75	845.28667	902.14	554.86	600.75	592.4	582.67
827.25	801.54	856.19	845.78	834.50333	903.59	547.15	589.9	585.62	574.22333
828.75	796.58	822.96	830.87	816.80333	905.05	524.24	559.18	524.24	535.88667
830.25	778.35	834.33	823.66	812.11333	906.51	479.53	510.9	515.38	501.93667
831.74	786.36	824.06	834.83	815.08333	907.97	459.45	514.59	487.02	487.02
833.23	801.69	842.6	834.42	826.23667	909.43	484.01	469.91	488.71	480.87667
834.72	822.18	869.09	869.09	853.45333	910.89	452.35	461.98	466.79	460.37333
836.21	841.45	891.6	897.17	876.74	912.35	444.25	463.99	449.19	452.47667
837.7	863.27	922.52	911.23	899.00667	913.82	424.53	434.64	449.8	436.32333
839.18	875.86	930.06	932.91	912.94333	915.28	456.06	461.24	471.61	462.97
840.67	893.71	951.37	945.61	930.23	916.74	472.95	488.9	483.58	481.81
842.15	907.81	951.6	939.92	933.11	918.21	533.05	565.68	533.05	543.92667
843.63	909.72	954.02	951.07	938.27	919.68	540.96	540.96	540.96	540.96
845.11	909.05	965.67	959.71	944.81	921.14	514.45	531.59	525.88	523.97333
846.59	908.45	968.81	956.74	944.66667	922.61	491.38	526.48	485.54	501.13333
848.07	902.01	947.87	953.99	934.62333	924.08	460.99	508.88	484.94	484.93667
849.54	876.38	929.02	938.31	914.57	925.55	399.4	423.98	430.12	417.83333
851.02	862.44	925.16	909.48	899.02667	927.02	314.96	359.05	321.25	331.75333
852.49	840.55	888.3	885.12	871.32333	928.49	284.57	291.04	278.11	284.57333
853.96	838.86	896.71	887.07	874.21333	929.97	226.28	212.97	206.32	215.19
855.43	855.04	916.81	894.05	888.63333	931.44	191.82	212.38	164.42	189.54
856.9	872.38	931.41	924.85	909.54667	932.92	182.61	168.57	168.57	173.25
858.37	870.71	926.78	933.38	910.29	934.4	172.43	172.43	165.25	170.03667
859.83	882.61	935.5	928.89	915.66667	935.88	197.38	212	204.69	204.69
861.3	890.5	943.46	936.84	923.6	937.36	222.75	245.03	215.33	227.70333
862.76	868.95	921.81	921.81	904.19	938.84	241.39	218.76	218.76	226.30333
864.23	847.92	920.5	904.01	890.81	940.32	200.8	185.35	200.8	195.65

941.81	212.77	212.77	212.77	212.77	1020.8	759.14	840.48	786.26	795.29333
943.29	209.15	217.2	217.2	214.51667	1022.33	736.32	736.32	821.28	764.64
944.78	204.67	204.67	196.48	201.94	1023.86	765.93	824.84	707.01	765.92667
946.27	241.74	208.39	225.06	225.06333	1025.39	709.15	709.15	739.99	719.43
947.76	203.29	220.23	211.76	211.76	1026.91	705.81	705.81	834.13	748.58333
949.25	224.25	181.13	215.63	207.00333	1028.44	870.61	837.13	803.64	837.12667
950.74	184.08	219.14	201.61	201.61	1029.96	630.78	806	735.92	724.23333
952.24	213.56	195.76	195.76	201.69333	1031.48	805.46	768.85	732.24	768.85
953.74	225.96	253.07	207.88	228.97	1033	803.62	803.62	803.62	803.62
955.23	238.94	238.94	229.75	235.87667	1034.51	918.03	878.11	878.11	891.41667
956.73	279.25	288.56	260.64	276.15	1036.02	834.95	793.2	751.46	793.20333
958.24	274.06	283.52	264.61	274.06333	1037.53	827.63	784.07	827.63	813.11
959.74	278.14	316.51	278.14	290.93	1039.03	774.88	866.05	820.46	820.46333
961.24	301.54	301.54	291.81	298.29667	1040.54	717.03	860.44	860.44	812.63667
962.75	325.61	296.01	305.87	309.16333	1042.03	846.23	945.78	796.45	862.82
964.26	350.96	360.99	340.93	350.96	1043.53	1094.05	729.37	729.37	850.93
965.77	406	345.1	375.55	375.55	1045.02	709.6	709.6	1091.69	836.96333
967.28	402.39	453.98	484.94	447.10333	1046.5	739.85	910.58	1081.32	910.58333
968.79	470.86	491.79	460.4	474.35	1047.98	831.23	1246.85	1068.73	1048.9367
970.3	446.74	457.38	436.11	446.74333	1049.46	806.81	930.93	744.75	827.49667
971.82	444.11	444.11	465.78	451.33333	1050.93	582.66	1035.83	1165.31	927.93333
973.34	419.22	430.25	408.19	419.22	1052.39	1079.47	1281.88	1012.01	1124.4533
974.85	437.21	448.43	426	437.21333	1053.85	921.19	992.06	921.19	944.81333
976.37	478.82	456.02	456.02	463.62	1055.3	885.65	1476.08	885.65	1082.46
977.9	464.89	523	511.38	499.75667	1056.75	996.2	613.05	766.31	791.85333
979.42	462.14	497.69	509.54	489.79	1058.19	964.39	1125.12	1125.12	1071.5433
980.94	518.89	530.96	530.96	526.93667	1059.62	997.78	1080.93	1080.93	1053.2133
982.47	529.11	566.02	566.02	553.71667	1061.05	1048.9	961.49	1223.72	1078.0367
983.99	590.25	577.7	602.81	590.25333	1062.46	1188.44	1097.02	1005.61	1097.0233
985.52	564.37	666.98	615.67	615.67333	1063.87	1049.75	1336.05	1049.75	1145.1833
987.05	616.83	603.71	590.59	603.71	1065.27	1093.39	1093.39	1292.18	1159.6533
988.58	604.61	604.61	698.67	635.96333	1066.67	1324.91	1426.82	1222.99	1324.9067
990.11	618.62	659.86	646.11	641.53	1068.05	939.03	1147.7	1147.7	1078.1433
991.64	636.05	720.85	636.05	664.31667	1069.42	961.91	961.91	1175.66	1033.16
993.17	666.21	666.21	695.18	675.86667	1070.79	1191.12	1191.12	1299.41	1227.2167
994.71	654.57	743.83	669.45	689.28333	1072.14	1638.25	1419.82	1201.39	1419.82
996.24	687.94	703.23	657.37	682.84667	1073.48	1101.68	1211.85	1322.02	1211.85
997.77	646.3	693.59	614.77	651.55333	1074.82	882.81	1103.51	993.16	993.16
999.31	647.5	744.63	679.88	690.67	1076.14	1329.57	664.79	1107.98	1034.1133
1000.85	603.08	686.84	720.35	670.09	1077.44	1223.75	1446.25	1335	1335
1002.38	657.72	657.72	726.95	680.79667	1078.74	1240.64	1240.64	1353.43	1278.2367
1003.92	696.38	607.1	678.53	660.67	1080.02	1149.32	1149.32	804.52	1034.3867
1005.45	684.63	758.65	721.64	721.64	1081.3	1049.61	816.37	1399.49	1088.49
1006.99	612.92	689.54	689.54	664	1082.55	949.35	1068.02	1424.03	1147.1333
1008.53	713.77	753.42	733.6	733.59667	1083.79	1107.18	738.12	1599.26	1148.1867
1010.06	721.07	700.47	741.67	721.07	1085.02	1130.76	1884.59	879.48	1298.2767
1011.6	706.15	684.75	727.55	706.15	1086.24	1423.89	1553.34	1553.34	1510.19
1013.13	644.03	799.49	777.28	740.26667	1087.43	1070.99	669.37	1472.62	1070.9933
1014.67	715.87	738.96	762.05	738.96	1088.62	967.46	1243.88	967.46	1059.6
1016.2	719.72	767.7	695.73	727.71667	1089.78	1580.9	1724.62	1724.62	1676.7133
1017.74	650.36	750.42	675.38	692.05333					
1019.27	754.44	702.41	728.43	728.42667					

APPENDIX C-2C

DOWNWELLING IRRADIANCE CALCULATION

MAY 12, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0.03	0.03	0.03	0.03
115.33	0.19	0.19	0.19	0.19
122.58	0.21	0.21	0.2	0.2066667
129.71	0.22	0.22	0.22	0.22
136.72	0.23	0.23	0.23	0.23
143.6	0.25	0.25	0.25	0.25
150.37	0.26	0.26	0.26	0.26
157.02	0.27	0.27	0.27	0.27
163.55	0.29	0.29	0.29	0.29
169.97	0.3	0.3	0.3	0.3
176.28	0.31	0.31	0.31	0.31
182.48	0.33	0.33	0.32	0.3266667
188.57	0.34	0.34	0.34	0.34
194.55	0.35	0.35	0.35	0.35
200.43	0.36	0.36	0.36	0.36
206.21	0.38	0.37	0.37	0.3733333
211.88	0.4	0.4	0.4	0.4
217.46	0.4	0.41	0.4	0.4033333
222.94	0.42	0.42	0.42	0.42
228.33	0.44	0.44	0.43	0.4366667
233.62	0.44	0.45	0.45	0.4466667
238.82	0.46	0.47	0.46	0.4633333
243.92	0.47	0.47	0.47	0.47
248.94	0.5	0.49	0.49	0.4933333
253.87	0.68	0.69	0.69	0.6866667
258.72	0.95	0.95	0.93	0.9433333
263.48	1.52	1.5	1.52	1.5133333
268.16	2.25	2.27	2.29	2.27
272.75	3.36	3.27	3.25	3.2933333
277.27	4.53	4.46	4.44	4.4766667
281.71	8.97	8.86	8.83	8.8866667
286.07	18.66	18.43	18.49	18.526667
290.36	28.86	28.69	28.61	28.72
294.57	41.27	41.75	41.51	41.51
298.71	54.77	55.22	55.07	55.02
302.78	127.12	128.13	128.13	127.79333
306.78	238.46	238.46	236.7	237.87333
310.71	367.01	366.18	362	365.06333
314.57	537.44	532.97	536.32	535.57667
318.37	740.06	737.29	740.06	739.13667
322.1	1256.95	1248.69	1252.82	1252.82
325.77	2141.8	2135.69	2132.64	2136.71
329.38	3206.03	3198.17	3190.32	3198.1733
332.93	5560.95	5543.56	5543.56	5549.3567
336.42	8408.09	8385.04	8377.35	8390.16
339.85	11338.42	11228.61	11301.82	11289.617
343.22	13959.66	13899.36	13899.36	13919.46
346.53	16780.95	16759.42	16770.18	16770.183
349.79	19614.2	19513.15	19490.7	19539.35
353	22570.58	22475.94	22535.09	22527.203
356.16	24696.27	24659.88	24599.23	24651.793
359.26	26865.22	26803.66	26803.66	26824.18
362.32	29725.51	29551.75	29663.45	29646.903
365.32	33399.7	33275.31	33262.87	33312.627
368.28	36985.46	36849.17	36787.21	36873.947
371.19	40834.76	40734.36	40621.42	40730.18
374.05	44703.08	44613.05	44613.05	44643.06
376.87	48170.76	48039.18	48012.87	48074.27
379.64	52057.91	51830.47	51817.09	51901.823
382.37	58960.64	58729.15	58742.77	58810.853
385.06	68557.94	68338.38	68310.94	68402.42
387.71	79296.95	79050.04	79008.89	79118.627
390.32	89241.38	88942.46	88928.87	89037.57
392.89	97488.47	97189.09	97175.48	97284.347
395.42	102451.95	102153.62	102153.62	102253.06
397.92	106324.7	106042.17	106001.81	106122.89
400.37	110236.19	109968.89	109861.97	110022.35
402.8	115793.59	115444.25	115403.94	115547.26
405.18	121250.3	120940.16	120899.71	121030.06
407.54	126438.24	126072.82	125991.61	126167.56
409.86	130885.38	130546.47	130451.58	130627.81
412.15	134827.47	134391.31	134336.79	134518.52
414.4	137668.54	137299.68	137163.06	137377.09
416.63	139831.39	139558.34	139380.85	139590.19
418.83	142190.77	141849.98	141727.29	141922.68
420.99	143915.26	143481.9	143360.02	143585.73
423.13	145322.72	144958.57	144796.72	145026
425.25	146161	145825.22	145677.47	145887.9
427.33	146349.52	145936.7	145870.12	146052.11
429.39	145085.34	144729.38	144637.09	144817.27
431.43	144587.03	144233.55	144024.08	144281.55
433.44	149291.14	148940.87	148850.06	149027.36
435.42	158289.71	157865.75	157814.36	157989.94
437.38	166548.23	166204.42	166038.87	166263.84
439.32	171622.41	171244.28	171080.42	171315.7
441.24	174715.53	174364.5	174126.3	174402.11
443.14	177992.3	177616.68	177428.87	177679.28
445.02	183922.58	183509.41	183309.08	183580.36
446.87	190658.32	190157.12	190031.82	190282.42
448.71	194529.93	194064.69	193863.51	194152.71
450.53	197477.58	197062.13	196898.47	197146.06
452.33	202383.21	202030.56	201829.04	202080.94
454.11	208343.12	207928.17	207701.84	207991.04
455.88	212293.15	211855.98	211706.09	211951.74
457.63	212493.35	212075.18	211866.09	212144.87
459.36	212750.02	212327.09	212169.99	212415.7
461.08	215335.16	214873.73	214672.59	214960.49
462.78	217811.43	217268.29	217152.72	217410.81

464.47	218175.17	217733.82	217586.7	217831.9	542.3	200411.96	199946.87	199899.42	200086.08
466.15	219287.87	218785.94	218618.63	218897.48	543.74	201378.02	200873.81	200836.46	201029.43
467.81	220402.94	219973.48	219819.31	220065.24	545.18	201582.41	201152.33	201079.12	201271.29
469.46	219552.34	219037.17	218850.83	219146.78	546.62	201374.84	200988.49	200952.55	201105.29
471.1	217379.54	216962.35	216720.81	217020.9	548.07	201324.39	200999.87	200894.62	201072.96
472.72	216148.87	215696.79	215432.15	215759.27	549.51	201149.58	200762.97	200685.64	200866.06
474.33	216088.04	215676.08	215509.07	215757.73	550.96	200529.35	200107.67	200031.76	200222.93
475.94	216418.99	215957.52	215777.43	216051.31	552.41	199938.93	199482.35	199449.15	199623.48
477.53	218193.02	217785.12	217603.83	217860.66	553.86	198556.51	198064.5	198039.9	198220.3
479.11	220283.99	219805.44	219577.55	219888.99	555.32	196215.93	195767.56	195759.41	195914.3
480.68	220988.89	220591.04	220477.37	220685.77	556.77	194396.67	194038.26	193948.66	194127.86
482.24	221395.94	220921.76	220707.25	221008.32	558.23	194050.19	193713.62	193606.9	193790.24
483.8	222024.7	221613.62	221446.97	221695.1	559.69	194191.73	193799.81	193666.4	193885.98
485.34	222493.67	222036.67	221884.34	222138.23	561.16	193722.14	193296.79	193228.73	193415.89
486.88	221901.84	221541.56	221361.42	221601.61	562.62	192668.35	192364.65	192199.79	192410.93
488.41	219200.12	218674.21	218540.15	218804.83	564.09	191912.86	191467.15	191404.75	191594.92
489.93	212616.05	212144.41	211943.72	212234.73	565.56	190774.9	190428.93	190346.99	190516.94
491.45	206371.1	205977.9	205761.64	206036.88	567.03	189820.91	189458.73	189356.57	189545.4
492.95	208222.37	207855.48	207720.3	207932.72	568.51	190206.77	189781.84	189687.41	189892.01
494.46	213088.35	212600.93	212572.26	212753.85	569.99	191208.7	190864.18	190749.34	190940.74
495.95	213613.94	213079	212964.37	213219.1	571.47	191528.68	191153.34	191105.22	191262.41
497.44	212784.02	212323.1	212188.66	212431.93	572.95	191387.19	191010.35	190971.7	191123.08
498.93	213487.28	212992.53	212817.92	213099.24	574.44	191746.08	191292.66	191244.43	191427.72
500.41	213446.72	212983.6	212894.92	213108.41	575.93	192115.02	191817.72	191693.05	191875.26
501.88	211466.74	211046.17	210936.02	211149.64	577.42	192559.53	192188.57	192112.47	192286.86
503.35	208903.27	208455.87	208323.69	208560.94	578.92	192144.42	191777.84	191702.65	191874.97
504.82	206152.04	205626.8	205451.72	205743.52	580.42	190501.33	190067.01	190048.53	190205.62
506.28	205524.06	205004.79	204942.48	205157.11	581.92	187585.52	187158.63	187149.55	187297.9
507.74	206325.97	205951.91	205806.44	206028.11	583.42	182601.5	182261.59	182252.64	182371.91
509.2	208368.13	208025.93	207870.39	208088.15	584.93	178539.72	178161.03	178125.8	178275.52
510.65	208049.18	207639.59	207475.76	207721.51	586.44	178467.46	178041.82	178059.19	178189.49
512.1	207257.06	206794.5	206774.39	206941.98	587.95	180152	179747.51	179781.94	179893.82
513.55	206828.37	206493.9	206346.34	206556.2	589.47	181008.51	180666.97	180684.04	180786.51
514.99	205362.06	204988.46	204863.93	205071.48	590.99	182190.38	181816.03	181824.53	181943.65
516.44	202486.43	202067.38	202011.5	202188.44	592.51	183475.78	183220.68	183178.16	183291.54
517.88	199111.87	198776.33	198631.23	198839.81	594.03	184685.6	184257.91	184249.36	184397.62
519.32	194693.02	194303.65	194179.76	194392.14	595.56	185364.33	184907.69	184907.69	185059.9
520.76	194684.98	194198.94	194190.26	194358.06	597.09	186097.18	185617.35	185617.35	185777.29
522.2	198620.26	198130.67	198027.6	198259.51	598.62	186843.82	186390.49	186390.49	186541.6
523.63	201082.85	200594.77	200492.01	200723.21	600.16	187193.92	186786.52	186795.57	186925.34
525.07	202089.46	201686.26	201566.16	201780.63	601.7	186781.93	186357.26	186394.18	186511.12
526.5	201535.63	201153.85	200988.99	201226.16	603.24	185969.87	185529.34	185473.1	185657.44
527.94	199706.93	199301.93	199205.09	199404.65	604.79	185083.3	184636.58	184608.07	184775.98
529.37	201127.28	200643.14	200535.55	200768.66	606.34	184357.62	183933.9	183972.42	184087.98
530.81	203400.17	202989.31	202898.01	203095.83	607.89	183799.9	183343.48	183362.9	183502.09
532.24	203597.57	203150.17	203084.92	203277.55	609.44	183272.93	182811.87	182802.06	182962.29
533.67	202572.41	202155.17	202088.79	202272.12	611	183032.81	182617.99	182608.12	182752.97
535.11	202977.89	202516.03	202439.06	202644.33	612.56	183542.47	183135.21	183135.21	183270.96
536.55	203013.3	202663.6	202508.17	202728.36	614.12	183880.65	183492.19	183422.47	183598.44
537.98	202094.81	201773.64	201617.92	201828.79	615.69	183154.33	182805.16	182765.25	182908.25
539.42	200332.63	199964.28	199896.43	200064.45	617.25	181908.78	181540.77	181580.55	181676.7
540.86	199635.97	199203.54	199136.28	199325.26	618.82	180575.87	180190.02	180180.13	180315.34

620.4	179723.44	179301.32	179222.79	179415.85	704.45	159927.13	159627.8	159723.58	159759.5
621.97	178890.96	178472.44	178452.98	178605.46	706.08	160544.45	160279.13	160315.31	160379.63
623.55	178426.73	178051.25	178012.74	178163.57	707.71	160452.39	160197.77	160343.27	160331.14
625.13	178447	178074.22	178083.77	178201.66	709.34	158914.55	158560.97	158573.16	158682.89
626.71	178997.89	178684.69	178608.76	178763.78	710.97	153792.04	153497.51	153583.41	153624.32
628.3	179679.96	179292.33	179216.7	179396.33	712.6	142392.61	142084.11	142108.79	142195.17
629.89	179695.92	179403.19	179318.21	179472.44	714.23	126925.97	126715.7	126740.44	126794.04
631.47	179627.11	179217.35	179217.35	179353.94	715.86	116828.61	116592.34	116604.78	116675.24
633.07	179484.05	179135.82	179126.15	179248.67	717.49	118121.46	117984.62	117984.62	118030.23
634.66	179134.94	178781.67	178820.92	178912.51	719.11	123678.05	123403.76	123503.51	123528.44
636.26	178523	178127.29	178127.29	178259.19	720.74	123642.11	123417.83	123442.75	123500.9
637.86	177574.54	177205.76	177175.86	177318.72	722.36	119815.78	119640.95	119703.39	119720.04
639.46	175662.68	175310.55	175300.49	175424.57	723.99	118555.67	118306	118405.87	118422.51
641.06	173081.53	172674.71	172745.9	172834.05	725.61	119229.85	118979.4	119004.44	119071.23
642.66	171194.37	170856.6	170907.78	170986.25	727.23	121253.8	121103.13	121153.35	121170.09
644.27	170791.43	170389.01	170440.6	170540.35	728.85	126503.28	126263.6	126314.06	126360.31
645.88	170581.75	170175.56	170269.29	170342.2	730.47	134234.26	134018.96	134082.28	134111.83
647.49	169916.39	169538.26	169601.28	169685.31	732.08	140780.36	140576.59	140525.65	140627.53
649.1	167662.58	167197.65	167313.88	167391.37	733.7	143966.33	143722.73	143722.73	143803.93
650.71	165940.58	165597.73	165629.87	165722.73	735.32	145700.22	145480.93	145442.23	145541.13
652.32	167990.93	167719.41	167730.27	167813.54	736.93	147653.39	147419.52	147458.49	147510.47
653.94	172228.02	171907.69	171918.73	172018.15	738.54	149744.5	149482.25	149534.7	149587.15
655.56	175246.36	175011.41	174899.53	175052.43	740.15	152011.53	151773.54	151813.21	151866.09
657.18	176617.1	176378.92	176333.55	176443.19	741.76	153922.35	153669.06	153669.06	153753.49
658.8	177085.26	176707.98	176719.41	176837.55	743.37	155286.34	155070.84	154976.55	155111.24
660.42	177317.99	176926.64	176926.64	177057.09	744.97	155827.93	155460.66	155583.08	155623.89
662.04	177251.32	176767.87	176859.96	176959.72	746.58	155568.51	155307.42	155321.17	155399.03
663.66	176941.58	176599.38	176633.6	176724.85	748.18	154929.58	154693.28	154637.68	154753.51
665.29	176676.95	176359.8	176405.1	176480.62	749.78	154296.89	154044.2	154086.31	154142.47
666.92	176599.65	176328.72	176317.43	176415.27	751.38	153979.87	153809.79	153880.66	153890.11
668.54	176780.82	176305.17	176407.1	176497.7	752.98	153718.09	153416.6	153430.96	153521.88
670.17	176823.18	176470.17	176447.4	176580.25	754.57	151807.57	151532.05	151561.06	151633.56
671.8	176710.44	176390.79	176436.45	176512.56	756.16	142399.7	142209.34	142223.99	142277.68
673.43	176516.35	176138.25	176229.91	176294.84	757.76	119287.11	119035.17	119168.55	119163.61
675.06	176100.92	175688.1	175756.9	175848.64	759.35	92843.94	92738.84	92663.77	92748.85
676.69	175204.46	174836.44	174836.44	174959.11	760.93	81609.59	81488.57	81473.44	81523.867
678.32	173050.81	172590.39	172693.98	172778.39	762.52	87456.92	87258.43	87273.7	87329.683
679.95	168321.77	167964.2	168033.41	168106.46	764.1	101182.56	100998.25	101090.41	101090.41
681.58	160098.5	159682.21	159693.77	159824.83	765.69	118777.37	118576.97	118638.63	118664.32
683.22	152621.33	152331.55	152319.96	152424.28	767.27	133592.82	133298.29	133422.3	133437.8
684.85	151452.43	151150.64	151115.82	151239.63	768.85	142283.23	142034.13	142143.11	142153.49
686.48	153353.43	153062.06	153097.03	153170.84	770.42	146384.58	146134.75	146165.98	146228.44
688.12	153624.74	153274.1	153274.1	153390.98	772	148074.73	147792.41	147855.15	147907.43
689.75	152854.35	152585.01	152596.72	152678.69	773.57	148752.86	148485.12	148516.62	148584.87
691.38	154320.54	154003.25	153967.99	154097.26	775.14	148905.5	148684.62	148684.62	148758.25
693.02	156784.32	156430.7	156477.85	156564.29	776.7	148900.14	148757.53	148630.77	148762.81
694.65	156388.5	156093.5	156058.1	156180.03	778.27	148608.19	148449.37	148481.13	148512.9
696.29	154097.62	153801.57	153825.26	153908.15	779.83	148478.05	148207.19	148270.92	148318.72
697.92	153486.8	153344.59	153249.77	153360.39	781.4	148113.56	147953.99	148065.69	148044.41
699.55	155229.65	154944.48	154968.24	155047.46	782.96	147518.22	147293.88	147390.02	147400.71
701.19	157341.73	157068.28	157032.61	157147.54	784.51	146209.39	146129.06	146129.06	146155.84
702.82	158858.26	158583.25	158607.17	158682.89	786.07	144308.77	144131.53	144212.09	144217.46

787.62	141534.14	141259.13	141291.48	141361.58	865.69	119629.18	119471.63	119471.63	119524.15
789.17	138959.46	138780.59	138650.51	138796.85	867.15	121028.83	120845.61	120976.48	120950.31
790.72	137470.17	137323.04	137323.04	137372.08	868.62	122935	122778.86	122804.88	122839.58
792.27	137222.78	137025.34	136975.98	137074.7	870.08	123414.39	123284.67	123440.33	123379.8
793.81	137010.84	136778.96	136911.46	136900.42	871.54	123200.63	123019.94	122994.13	123071.57
795.35	136544.94	136361.27	136411.36	136439.19	873	122668.1	122564.8	122616.45	122616.45
796.89	136282.13	136130.89	136114.09	136175.7	874.46	122284.14	122232.56	122206.78	122241.16
798.43	135977.67	135824.63	135909.65	135903.98	875.91	122039.5	121987.79	121936.08	121987.79
799.97	134894.93	134740.69	134672.13	134769.25	877.37	121338.26	121053.36	121260.56	121217.39
801.5	133608.74	133418.32	133418.32	133481.79	878.83	120382.5	120278.46	120356.49	120339.15
803.03	133278.24	133243.25	133208.26	133243.25	880.29	119849.43	119666.1	119849.43	119788.32
804.56	134116.12	133956.92	133939.23	134004.09	881.74	119729.83	119571.53	119729.83	119677.06
806.09	134898.85	134755.93	134773.8	134809.53	883.2	119005.38	118952.13	119138.49	119032
807.61	134027.7	133973.35	133919.01	133973.35	884.66	117824.7	117717.05	117770.88	117770.88
809.14	130956.05	130846.32	130864.61	130888.99	886.11	117350.04	117105.17	117241.21	117232.14
810.66	125829.56	125644.27	125662.8	125712.21	887.57	117022.03	116939.33	116911.76	116957.71
812.17	117669.25	117463.73	117519.78	117550.92	889.03	115159.33	115187.28	115271.13	115205.91
813.69	107698.67	107585.17	107604.09	107629.31	890.48	110973.7	110689.73	110831.71	110831.71
815.21	99364.02	99268.35	99230.08	99287.483	891.94	103523.8	103581.53	103552.67	103552.67
816.72	95718.71	95660.73	95602.75	95660.73	893.39	94335.94	94070.79	94159.17	94188.633
818.23	97305.07	97187.84	97324.61	97272.507	894.85	85022.6	84932.7	84992.64	84982.647
819.74	101444.3	101385.06	101523.29	101450.88	896.31	78164.87	78103.68	78256.65	78175.067
821.25	102205.61	101965.97	102005.91	102059.16	897.76	74241.75	74147.93	74179.2	74189.627
822.75	100755.67	100614.5	100654.84	100675	899.22	74590	74462.11	74558.03	74536.713
824.25	104045.41	103902.63	104045.41	103997.82	900.68	79683.46	79911.96	79879.32	79824.913
825.75	108443.63	108216.85	108402.4	108354.29	902.14	85973.48	85739.85	85839.98	85851.103
827.25	107885.56	107802.28	107906.38	107864.74	903.59	85218.5	85286.89	85526.27	85343.887
828.75	106878.68	106730.97	106752.07	106787.24	905.05	78775.07	78705.17	78740.12	78740.12
830.25	107646.76	107540.13	107582.78	107589.89	906.51	73318.48	73426.04	73390.18	73378.233
831.74	109099.3	109077.76	108970.04	109049.03	907.97	72005.41	71858.38	71931.89	71931.893
833.23	111517.4	111517.4	111561.03	111531.94	909.43	71351.26	71313.67	71501.64	71388.857
834.72	115171.93	115083.64	115127.78	115127.78	910.89	69026.8	69065.3	69065.3	69052.467
836.21	118649.73	118315.38	118538.28	118501.13	912.35	67288.91	67209.93	67288.91	67262.583
837.7	121309.46	121219.18	121219.18	121249.27	913.82	66914.36	66954.79	66873.93	66914.36
839.18	123338.73	123338.73	123315.9	123331.12	915.28	69197.06	68989.76	69031.22	69072.68
840.67	125096.92	124866.28	124797.09	124920.1	916.74	74652.37	74567.34	74864.93	74694.88
842.15	125844.11	125774.05	125797.4	125805.19	918.21	79761.41	79804.92	79587.35	79717.893
843.63	126769.98	126580.95	126651.84	126667.59	919.68	80217.96	79994.88	80173.34	80128.727
845.11	127469.07	127492.91	127445.22	127469.07	921.14	78058.59	78104.32	78058.59	78073.833
846.59	127629.39	127387.94	127581.1	127532.81	922.61	76234.86	75907.27	76000.87	76047.667
848.07	125877.62	125730.85	125681.93	125763.47	924.08	72225.51	72033.93	72273.4	72177.613
849.54	123869.43	123720.79	123918.98	123836.4	925.55	62527.77	62576.92	62527.77	62544.153
851.02	122485.48	122259.68	122334.95	122360.04	927.02	50241.74	50090.56	50191.34	50174.547
852.49	119790.59	119790.59	119765.12	119782.1	928.49	38909.03	39115.99	39012.51	39012.51
853.96	118609.9	118429.91	118429.91	118489.91	929.97	29763.09	29390.38	29496.87	29550.113
855.43	121461.08	121435.07	121331.04	121409.06	931.44	23950.62	23950.62	23950.62	23950.62
856.9	124677.7	124572.75	124651.46	124633.97	932.92	22082.36	22250.93	21913.79	22082.36
858.37	125725.32	125698.94	125619.78	125681.35	934.4	22703.42	22645.94	22703.42	22684.26
859.83	126090.78	126011.45	125958.56	126020.26	935.88	27018.46	26901.5	26901.5	26940.487
861.3	126351.09	126245.16	126245.16	126280.47	937.36	31660.53	31541.73	31482.33	31561.53
862.76	125023.08	124917.35	124890.92	124943.78	938.84	31501.93	31622.62	31562.28	31562.277
864.23	121783.61	121440.48	121572.45	121598.85	940.32	29409.49	29841.99	29718.42	29656.633

941.81	28369.77	28243.68	28117.59	28243.68	1020.8	98254.78	96953.39	97604.09	97604.087
943.29	27865.45	27929.81	27929.81	27908.357	1022.33	98553.28	97420.48	97420.48	97798.08
944.78	28620.99	28686.49	28817.47	28708.317	1023.86	97567.22	98274.23	98038.56	97960.003
946.27	29675.23	29541.86	29741.92	29653.003	1025.39	98664.98	98171.66	98171.66	98336.1
947.76	30358.39	30358.39	30629.45	30448.743	1026.91	97529.59	99069.53	98299.56	98299.56
949.25	30705.64	30360.63	30705.64	30590.637	1028.44	98847.82	98312.06	99115.7	98758.527
950.74	30924.81	30854.69	30924.81	30901.437	1029.96	98963.1	98963.1	98122.05	98682.75
952.24	31962.49	32176.04	31962.49	32033.673	1031.48	99291.64	98998.75	99291.64	99194.01
953.74	33839.66	33405.82	33622.74	33622.74	1033	99189.54	99189.54	99495.68	99291.587
955.23	35656.99	35436.44	35804.03	35632.487	1034.51	99306.54	98667.91	99625.85	99200.1
956.73	36265.78	36191.31	36265.78	36240.957	1036.02	99860.05	99860.05	98858.11	99526.07
958.24	38558.05	38709.26	38255.64	38507.65	1037.53	100012	99663.52	100012	99895.84
959.74	41510.22	41740.41	41893.87	41714.833	1039.03	98820.41	98820.41	99914.37	99185.063
961.24	44667.06	44667.06	44589.24	44641.12	1040.54	101722.71	102105.13	101340.3	101722.71
962.75	47440.14	47361.2	47124.39	47308.577	1042.03	101547.11	99157.77	100750.66	100485.18
964.26	52624.19	52864.85	52864.85	52784.63	1043.53	101277.96	101277.96	102111.52	101555.81
965.77	61144.3	61306.71	61631.51	61360.84	1045.02	100872.33	102182.36	102182.36	101745.68
967.28	68344.96	67849.71	67684.63	67959.767	1046.5	98798.17	102440.5	101529.92	100922.86
968.79	70817.25	71152.08	70733.54	70900.957	1047.98	102598.08	102598.08	101648.09	102281.42
970.3	70117.59	69862.31	69777.21	69919.037	1049.46	102775.17	104264.67	101782.18	102940.67
971.82	66638.67	66725.33	66552.01	66638.67	1050.93	100993.61	103065.27	102547.35	102202.08
973.34	65662.68	65662.68	66103.96	65809.773	1052.39	103629.51	100930.82	103629.51	102729.95
974.85	68340.03	67981.29	67532.86	67951.393	1053.85	104307.52	105441.29	104874.4	104874.4
976.37	70044.73	69953.53	70044.73	70014.33	1055.3	103915.76	103915.76	105096.62	104309.38
977.9	72150.6	72150.6	72336.56	72212.587	1056.75	105443.89	102991.71	103604.75	104013.45
979.42	76027.8	76501.79	76501.79	76343.793	1058.19	107368.96	106726.03	102225.53	105440.17
980.94	80029.45	80222.52	79836.37	80029.447	1059.62	104434.82	103769.63	101108.87	103104.44
982.47	82688.27	83377.34	82983.59	83016.4	1061.05	106988.09	104191.02	104191.02	105123.38
983.99	86604.06	86403.13	86905.47	86637.553	1062.46	106045.65	106777	108239.69	107020.78
985.52	89375.27	89272.65	89683.1	89443.673	1063.87	108410.83	109174.28	106883.91	108156.34
987.05	91448.86	90923.89	91133.88	91168.877	1065.27	107350.71	109736.28	108941.09	108676.03
988.58	92653.84	92653.84	92653.84	92653.84	1066.67	105177.27	108438.58	106807.93	106807.93
990.11	94029.58	93479.7	93919.61	93809.63	1068.05	105171.01	105171.01	108509.77	106283.93
991.64	94983.1	94756.95	95209.25	94983.1	1069.42	108588.56	106023.48	110298.62	108303.55
993.17	95934.16	95470.71	96050.02	95818.297	1070.79	106551.5	103952.68	108284.05	106262.74
994.71	96281.22	96400.23	96638.26	96439.903	1072.14	110964.46	110090.73	110090.73	110381.97
996.24	97595.98	96862.18	97106.78	97188.313	1073.48	106642.68	106642.68	105761.33	106348.9
997.77	96724.48	96598.37	97102.8	96808.55	1074.82	110350.86	110350.86	104171.21	108290.98
999.31	96218.68	96607.18	96348.18	96391.347	1076.14	104592.94	108138.46	109024.84	107252.08
1000.85	95554.84	96090.91	96358.95	96001.567	1077.44	108579.77	106799.77	105909.77	107096.44
1002.38	95957.52	95265.18	95819.05	95680.583	1078.74	106469.55	109176.4	106469.55	107371.83
1003.92	95136.67	95279.52	94708.13	95041.44	1080.02	106656.68	109415.05	109415.05	108495.59
1005.45	95182.25	94886.2	95182.25	95083.567	1081.3	110092.82	108226.84	102628.9	106982.85
1006.99	95462.75	95769.22	95156.29	95462.753	1082.55	107276.97	105378.26	108226.32	106960.52
1008.53	96755.37	96438.14	95962.29	96385.267	1083.79	107273.49	103336.85	108257.65	106289.33
1010.06	97241.39	96746.94	96746.94	96911.757	1085.02	106542.4	109557.75	105537.28	107212.48
1011.6	97406.29	97577.48	96892.73	97292.167	1086.24	109769.12	105626.89	111840.24	109078.75
1013.13	97182.18	97537.51	97182.18	97300.623	1087.43	109241.3	108170.3	108170.3	108527.3
1014.67	97727.59	97912.33	98281.81	97973.91	1088.62	109461.22	111672.55	109461.22	110198.33
1016.2	98649.35	98457.43	98457.43	98521.403	1089.78	109225.84	106926.35	109225.84	108459.34
1017.74	97654.34	98454.78	98054.56	98054.56					
1019.27	98441.74	98441.74	97817.38	98233.62					

APPENDIX C-3A

TOTAL SKY RADIANCE CALCULATION

AUGUST 14, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0	0	0	0
115.33	0.06	0.06	0.06	0.06
122.58	0.06	0.06	0.06	0.06
129.71	0.06	0.07	0.06	0.0633333
136.72	0.07	0.07	0.07	0.07
143.6	0.08	0.08	0.07	0.0766667
150.37	0.08	0.08	0.08	0.08
157.02	0.08	0.09	0.08	0.0833333
163.55	0.09	0.09	0.09	0.09
169.97	0.09	0.1	0.09	0.0933333
176.28	0.09	0.1	0.09	0.0933333
182.48	0.1	0.11	0.1	0.1033333
188.57	0.11	0.11	0.1	0.1066667
194.55	0.11	0.12	0.11	0.1133333
200.43	0.11	0.12	0.11	0.1133333
206.21	0.12	0.13	0.11	0.12
211.88	0.12	0.13	0.12	0.1233333
217.46	0.13	0.13	0.13	0.13
222.94	0.13	0.14	0.13	0.1333333
228.33	0.14	0.15	0.14	0.1433333
233.62	0.14	0.15	0.14	0.1433333
238.82	0.14	0.16	0.15	0.15
243.92	0.15	0.16	0.15	0.1533333
248.94	0.15	0.17	0.15	0.1566667
253.87	0.22	0.23	0.22	0.2233333
258.72	0.31	0.33	0.3	0.3133333
263.48	0.49	0.53	0.5	0.5066667
268.16	0.74	0.79	0.73	0.7533333
272.75	1.07	1.17	1.07	1.1033333
277.27	1.48	1.59	1.52	1.53
281.71	3.04	3.23	3.01	3.0933333
286.07	6.41	6.88	6.46	6.5833333
290.36	10.11	10.92	10.24	10.423333
294.57	15.02	16.44	15.37	15.61
298.71	20.9	22.03	20.82	21.25
302.78	50.95	55.32	51.96	52.743333
306.78	101.02	106.9	99.55	102.49
310.71	164.74	175.58	165.57	168.63
314.57	258.1	273.75	256.99	262.94667
318.37	381.79	399.08	381.79	387.55333
322.1	682.14	713.1	683.17	692.80333
325.77	1234.13	1279.89	1224.97	1246.33
329.38	1956.62	2025.38	1948.77	1976.9233
332.93	3499.52	3615.49	3485.02	3533.3433
336.42	5449.12	5622.05	5441.44	5504.2033
339.85	7458.29	7655.04	7449.13	7520.82
343.22	9236.09	9507.44	9246.14	9329.89
346.53	11167.56	11463.57	11146.04	11259.057
349.79	13034.97	13399.86	13018.13	13150.987
353	15035.22	15478.83	15017.48	15177.177
356.16	16332.78	16769.45	16357.04	16486.423
359.26	17563.35	18031.21	17587.98	17727.513
362.32	19163.33	19697.03	19181.95	19347.437
365.32	21364.61	21887.07	21408.15	21553.277
368.28	23603.79	24179.94	23647.15	23810.293
371.19	25964.08	26578.98	26008	26183.687
374.05	28209.49	28916.82	28260.93	28462.413
376.87	30039.29	30769.55	30098.5	30302.447
379.64	31902.36	32651.59	32009.4	32187.783
382.37	35403.62	36268.28	35539.78	35737.227
385.06	40714.86	41668.57	40852.08	41078.503
387.71	46726.35	47796.26	46911.53	47144.713
390.32	52345.07	53561.13	52576.05	52827.417
392.89	56936.32	58263.11	57194.87	57464.767
395.42	59301.44	60732.11	59640.46	59891.337
397.92	60777.15	62243.61	61133.67	61384.81
400.37	62181.61	63678.51	62615.98	62825.367
402.8	64487.28	66052.6	64923.96	65154.613
405.18	66720.03	68311.17	67165.01	67398.737
407.54	68619.34	70304.37	69079.51	69334.407
409.86	70180.59	71881.9	70688.95	70917.147
412.15	71373.23	73131.5	71884.36	72129.697
414.4	71996.94	73738.81	72502.43	72746.06
416.63	72134.27	73950.08	72721.34	72935.23
418.83	72431.28	74244.27	72990.17	73221.907
420.99	72336.82	74151.5	72898.83	73129.05
423.13	72148.85	74016.8	72762.51	72976.053
425.25	71656.77	73470.01	72274.62	72467.133
427.33	70864.33	72682.05	71443.6	71663.327
429.39	69372.02	71191.35	69991.64	70185.003
431.43	68091.01	69897.69	68693.24	68893.98
433.44	69112.66	70902.91	69683.47	69899.68
435.42	72284.48	74134.47	72881.87	73100.273
437.38	75359.92	77301.86	76015.73	76225.837
439.32	76943.96	78985.89	77624.6	77851.483
441.24	77541.3	79584.83	78237.1	78454.41
443.14	77965.53	80094.03	78641.64	78900.4
445.02	79497.37	81625.82	80192.25	80438.48
446.87	81571.09	83707.47	82197.59	82492.05
448.71	82390.11	84640.82	83113.1	83381.343
450.53	82649.52	84903.02	83373.41	83641.983
452.33	83672.46	85958.39	84409.25	84680.033
454.11	85077.53	87422.63	85850.85	86117.003
455.88	85849.07	88216.07	86635.99	86900.377
457.63	85030.55	87355.1	85811.55	86065.733
459.36	84055.96	86370.03	84811.2	85079.063
461.08	83974.8	86311.54	84838.5	85041.613
462.78	84169.65	86527.12	84949.69	85215.487

464.47	83500.47	85848.69	84309.61	84552.923	542.3	48254.53	49906.04	48425.38	48861.983
466.15	83030.46	85378.38	83816.82	84075.22	543.74	48119.89	49814.61	48297.3	48743.933
467.81	82699.28	85055.83	83481.12	83745.41	545.18	47831.1	49514.84	48014.11	48453.35
469.46	81605.95	83990.01	82395.16	82663.707	546.62	47475.33	49124.03	47646.04	48081.8
471.1	80068.13	82362.69	80787.24	81072.687	548.07	47142.92	48818.14	47331.49	47764.183
472.72	78650.71	80993.8	79422.55	79689.02	549.51	46818.63	48455.29	46981.87	47418.597
474.33	77820.86	80092.19	78522.3	78811.783	550.96	46385.64	48030.23	46562.75	46992.873
475.94	77026.39	79294.35	77701.71	78007.483	552.41	45960.63	47575.25	46159.87	46565.25
477.53	76742.03	79002.48	77393.54	77712.683	553.86	45379.19	47015.1	45543.19	45979.16
479.11	76563.3	78836.44	77212.77	77537.503	555.32	44629.36	46186.44	44763.87	45193.223
480.68	76012.17	78291.29	76631.68	76978.38	556.77	43897.07	45461.04	44015.19	44457.767
482.24	75208.01	77432.13	75778.15	76139.43	558.23	43529.54	45081.08	43623.94	44078.187
483.8	74637.81	76843.17	75221.09	75567.357	559.69	43244.52	44774.67	43327.9	43782.363
485.34	74023.1	76242.82	74599.79	74955.237	561.16	42871.19	44427.98	42943.5	43414.223
486.88	73216.69	75426.07	73810.1	74150.953	562.62	42344.69	43889.23	42401.09	42878.337
488.41	71672.88	73853.85	72301.91	72609.547	564.09	41860.88	43376.28	41847.5	42361.553
489.93	69054.06	71156.33	69621.02	69943.803	565.56	41311.5	42809.18	41265.98	41795.553
491.45	66249.31	68269.38	66740.81	67086.5	567.03	40745.56	42240.72	40638.76	41208.347
492.95	66041.04	68044.48	66514.14	66866.553	568.51	40490.82	41963.9	40363.34	40939.353
494.46	66981.96	69084.55	67469.38	67845.297	569.99	40423.7	41887.91	40261.01	40857.54
495.95	66786.6	68840.39	67240.34	67622.443	571.47	40209.38	41691.49	40055.39	40652.087
497.44	65950.66	68005.62	66406.78	66787.687	572.95	39906.55	41375.27	39751.95	40344.59
498.93	65558.55	67610.29	65980.54	66383.127	574.44	39731.65	41154.6	39533.88	40140.043
500.41	65018.38	67058.06	65442.08	65839.507	575.93	39570.02	41032.55	39387.8	39996.79
501.88	63896.64	65909.37	64297.18	64701.063	577.42	39403.17	40882.28	39250.98	39845.477
503.35	62523.54	64475.82	62864.17	63287.843	578.92	39120.69	40591.71	38937.4	39549.933
504.82	61015.52	62967.16	61319.34	61767.34	580.42	38525.35	39962.31	38331.29	38939.65
506.28	60140.97	62062.24	60395.41	60866.207	581.92	37706.93	39128.38	37429.91	38088.407
507.74	59683.56	61585.03	59896.56	60388.383	583.42	36481.84	37828.05	36088.26	36799.383
509.2	59729.29	61626.94	59931.5	60429.243	584.93	35301.95	36618.57	34791.16	35570.56
510.65	59149.33	61023.18	59364.36	59845.623	586.44	34989.87	36266.81	34412.21	35222.963
512.1	58408.26	60283.64	58624.46	59105.453	587.95	35104.38	36429.72	34596.62	35376.907
513.55	57803.73	59623.63	58059.5	58495.62	589.47	35114.75	36416.87	34589.63	35373.75
514.99	56968.38	58826.77	57246.18	57680.443	590.99	35155.07	36482.32	34712.65	35450.013
516.44	55710.77	57540.64	56022.74	56424.717	592.51	35254.7	36598.22	34825.28	35559.4
517.88	54434.73	56207.66	54752.14	55131.51	594.03	35335.85	36665.96	34968.03	35656.613
519.32	52830.2	54538.12	53122.23	53496.85	595.56	35299.7	36665.33	35006.75	35657.26
520.76	52292.67	54015.51	52609.47	52972.55	597.09	35272.18	36646.25	35006.09	35641.507
522.2	52953.38	54675.54	53232.53	53620.483	598.62	35270.99	36617.66	35017.66	35635.437
523.63	53342.66	55085.21	53625.23	54017.7	600.16	35167.32	36538.89	34918.36	35541.523
525.07	53278.29	55049.8	53587.12	53971.737	601.7	34947.76	36277.16	34680.03	35301.65
526.5	52876.31	54663.73	53184.34	53574.793	603.24	34577.03	35931.43	34342.71	34950.39
527.94	52024.35	53767.59	52332.5	52708.147	604.79	34249.87	35585.26	33983.74	34606.29
529.37	51938.23	53659.64	52216.17	52604.68	606.34	33936.29	35260.42	33637.75	34278.153
530.81	52178.47	53931.45	52475.2	52861.707	607.89	33604.88	34925.57	33347.54	33959.33
532.24	51945.67	53684.03	52229.96	52619.887	609.44	33337.96	34642.63	33033.86	33671.483
533.67	51212.07	52990.11	51534.49	51912.223	611	33101.36	34400.13	32795.19	33432.227
535.11	50905.64	52647.24	51199.12	51584	612.56	32967.72	34278.88	32664.76	33303.787
536.55	50566.33	52305.14	50828.61	51233.36	614.12	32829.78	34129.63	32540.93	33166.78
537.98	49932.45	51694.03	50195.23	50607.237	615.69	32532.61	33829.53	32223.35	32861.83
539.42	49077.47	50783.5	49344.04	49735.003	617.25	32151.57	33419.73	31823.34	32464.88
540.86	48460.37	50127.61	48671.78	49086.587	618.82	31713.56	32960.14	31357.4	32010.367

620.4	31344.6	32591.32	30971.57	31635.83	704.45	22413.98	23401.78	21869.2	22561.653
621.97	30979.87	32245.14	30580.82	31268.61	706.08	22492.14	23469.01	21973.56	22644.903
623.55	30735.84	31972.98	30312.23	31007.017	707.71	22443.69	23425.83	21982.94	22617.487
625.13	30591.87	31839.25	30166.52	30865.88	709.34	22238.77	23232.44	21769.37	22413.527
626.71	30532.14	31765.96	30128.78	30808.96	710.97	21537.27	22525.16	21040.25	21700.893
628.3	30495.01	31700.44	30088.48	30761.31	712.6	19978.65	20867.14	19367.81	20071.2
629.89	30268.8	31482.2	29867.48	30539.493	714.23	17730.3	18503.34	17006.74	17746.793
631.47	30041.09	31232.25	29669.44	30314.26	715.86	16066.27	16756.42	15313.94	16045.543
633.07	30001.07	31210.2	29618.98	30276.75	717.49	16079.2	16782.08	15295.45	16052.243
634.66	29831.29	31067.72	29487.84	30128.95	719.11	16862.36	17591.71	16151.71	16868.593
636.26	29603.79	30825.54	29222.93	29884.087	720.74	16945.81	17724.57	16285.42	16985.267
637.86	29298.4	30519.38	28899.72	29572.5	722.36	16420.82	17132.59	15659.09	16404.167
639.46	28859.59	30056.83	28416.91	29111.11	723.99	16166.11	16871.43	15460.8	16166.113
641.06	28268.9	29469.02	27760.37	28499.43	725.61	16235.85	16899.56	15503.26	16212.89
642.66	27803.99	28924.74	27225.7	27984.81	727.23	16448.43	17195.51	15820.63	16488.19
644.27	27581.29	28711.16	27008.61	27767.02	728.85	17131.18	17913.31	16569.81	17204.767
645.88	27433.9	28563.96	26861.05	27619.637	730.47	18256.32	19066.86	17762.39	18361.857
647.49	27225.27	28359.66	26689.59	27424.84	732.08	19262.74	20109.66	18867.93	19413.443
649.1	26733.87	27875.08	26237.23	26948.727	733.7	19737.84	20635.3	19468.6	19947.247
650.71	26335.35	27444.27	25821.07	26533.563	735.32	20007.17	20935.94	19807.23	20250.113
652.32	26461.72	27634.66	25989.29	26695.223	736.93	20340.67	21237.19	20152.27	20576.71
653.94	27068.03	28183.67	26565.44	27272.38	738.54	20612.82	21609.36	20606.26	20942.813
655.56	27415.81	28584.94	26973.89	27658.213	740.15	20976.45	21941.65	21035.95	21318.017
657.18	27543.97	28729.2	27095.96	27789.71	741.76	21283.3	22249.82	21396.62	21643.247
658.8	27473.43	28662.45	27033.26	27723.047	743.37	21496.83	22507.02	21631.53	21878.46
660.42	27377.53	28557.35	26905.6	27613.493	744.97	21573.24	22545.81	21743.27	21954.107
662.04	27228.26	28396.58	26739.06	27454.633	746.58	21526.2	22543.07	21732.32	21933.863
663.66	27034.01	28197.5	26560.63	27264.047	748.18	21378.22	22441.58	21635.38	21818.393
665.29	26861.74	28028.41	26374.68	27088.277	749.78	21310.41	22328.2	21528	21722.203
666.92	26714.59	27899.9	26291.27	26968.587	751.38	21253.02	22230.99	21472.71	21652.24
668.54	26613.38	27791.17	26154.73	26853.093	752.98	21176.26	22145.34	21377.25	21566.283
670.17	26532.59	27688.41	26065.7	26762.233	754.57	20880.97	21867.02	21069.48	21272.49
671.8	26422.66	27564.27	25943.18	26643.37	756.16	19730.96	20690.05	19906.67	20109.227
673.43	26283.82	27435.31	25796.87	26505.333	757.76	16672.63	17502.56	16724.5	16966.563
675.06	26110.69	27268.87	25629.07	26336.21	759.35	12889.15	13482.19	12754.03	13041.79
676.69	25905.74	27044.33	25388.2	26112.757	760.93	10861.11	11420.8	10588.82	10956.91
678.32	25473.02	26618.33	24995.33	25695.56	762.52	11336.72	11886.38	11031.36	11418.153
679.95	24741.33	25831.33	24204.98	24925.88	764.1	13047.14	13738.28	12816.76	13200.727
681.58	23422.14	24485.99	22878.65	23595.593	765.69	15438.75	16201.82	15338.54	15659.703
683.22	22092.83	23066.49	21519.06	22226.127	767.27	17594.32	18439.16	17602.07	17878.517
684.85	21711.51	22663.31	21061.5	21812.107	768.85	18916.09	19850.22	19056.21	19274.173
686.48	21940.1	22884.14	21269.95	22031.397	770.42	19580.4	20486.03	19728.74	19931.723
688.12	21932.2	22896.44	21225.09	22017.91	772	19856.22	20750.22	19981.7	20196.047
689.75	21781.13	22723.81	21025.82	21843.587	773.57	19891.46	20836.42	20088.33	20272.07
691.38	21887.15	22874.27	21187.93	21983.117	775.14	19918.75	20881.16	20068.64	20289.517
693.02	22266.42	23232.98	21570.96	22356.787	776.7	19862.33	20813.06	20052.48	20242.623
694.65	22213.94	23181.56	21535.43	22310.31	778.27	19796.95	20749.88	19987.54	20178.123
696.29	21812.63	22783.66	21125.81	21907.367	779.83	19732.81	20688.78	19884.17	20101.92
697.92	21622.78	22559.04	20935.41	21705.743	781.4	19635.18	20608.56	19810.71	20018.15
699.55	21815.8	22796.09	21150.4	21920.763	782.96	19501.38	20430.78	19645.59	19859.25
701.19	22102.03	23076.95	21483.79	22220.923	784.51	19254.14	20210.02	19390.7	19618.287
702.82	22293.48	23256.01	21701.62	22417.037	786.07	18957.04	19891.6	19013.44	19287.36

787.62	18482.43	19436.88	18458.16	18792.49	865.69	14375.98	15124.32	14310.34	14603.547
789.17	18105.7	18951.23	18008.14	18355.023	867.15	14461.17	15180.95	14382.64	14674.92
790.72	17852	18718.44	17786.6	18119.013	868.62	14651.23	15536.03	14612.19	14933.15
792.27	17786.31	18658.35	17761.63	18068.763	870.08	14736.05	15488.41	14684.16	14969.54
793.81	17780.6	18625.33	17706.07	18037.333	871.54	14687.02	15564.63	14648.3	14966.65
795.35	17631.63	18491.5	17556.49	17893.207	873	14616.87	15482.01	14591.05	14896.643
796.89	17526.79	18383.8	17417.56	17776.05	874.46	14569.92	15369.33	14492.55	14810.6
798.43	17471.18	18321.36	17292.65	17695.063	875.91	14479.26	15358.36	14453.41	14763.677
799.97	17283.9	18123.67	17121.08	17509.55	877.37	14464.76	15189.94	14361.17	14671.957
801.5	17042.99	17899.9	16869.88	17270.923	878.83	14293.47	15086.83	14241.45	14540.583
803.03	16970.32	17792.59	16777.87	17180.26	880.29	14234.74	14994.27	14077.59	14435.533
804.56	17016.58	17865.64	16857.38	17246.533	881.74	14207.69	14999.21	14115.35	14440.75
806.09	17159.36	17954.36	17016.44	17376.72	883.2	14163.5	14895.64	13977.14	14345.427
807.61	17036.5	17851.64	16909.7	17265.947	884.66	13927.43	14707.9	13792.86	14142.73
809.14	16540.95	17409.6	16385.51	16778.687	886.11	13930.73	14692.56	13713.06	14112.117
810.66	15897.77	16648.19	15601.31	16049.09	887.57	13769.73	14486.47	13645.68	13967.293
812.17	14844.11	15582.11	14451.76	14959.327	889.03	13584.33	14380.94	13458.55	13807.94
813.69	13526.18	14169.38	13034.32	13576.627	890.48	13062.41	13857.51	12792.64	13237.52
815.21	12398.98	12982.57	11815.38	12398.977	891.94	12179.27	12871.93	11832.94	12294.713
816.72	11759.51	12397.24	11237.72	11798.157	893.39	11048.09	11769.9	10620.9	11146.297
818.23	11889.59	12505.07	11352.26	11915.64	894.85	9934.79	10564.14	9455.28	9984.7367
819.74	12450.97	13033.53	11937.53	12474.01	896.31	9070.8	9636.76	8581.31	9096.29
821.25	12561.03	13220.03	12121.69	12634.25	897.76	8600.03	9131.67	8037.12	8589.6067
822.75	12362.54	13007.89	11888.6	12419.677	899.22	8536.45	9079.97	7960.96	8525.7933
824.25	12656.38	13298.88	12217.84	12724.367	900.68	8993.36	9613.59	8471.06	9026.0033
825.75	13256.51	13926.55	12833.87	13338.977	902.14	9812.19	10362.87	9211.44	9795.5
827.25	13189.02	13876.06	12772.63	13279.237	903.59	9848.69	10447.13	9387.03	9894.2833
828.75	13072.33	13684.27	12555.34	13103.98	905.05	9104.22	9645.93	8614.93	9121.6933
830.25	13093.33	13743.73	12666.83	13167.963	906.51	8425.35	8963.14	7851.71	8413.4
831.74	13195.76	13960.57	12883.37	13346.567	907.97	8215.01	8766.35	7608.53	8196.63
833.23	13547.01	14234.17	13121.62	13634.267	909.43	8101.26	8683.95	7499.78	8094.9967
834.72	13982.64	14677.91	13640.52	14100.357	910.89	7930.58	8469.55	7256.86	7885.6633
836.21	14432.78	15146.06	14120.72	14566.52	912.35	7621.34	8154.44	7068.49	7614.7567
837.7	14726.4	15482.47	14478.14	14895.67	913.82	7560.72	8045.9	6954.24	7520.2867
839.18	14972.28	15771.11	14778.28	15173.89	915.28	7753.06	8333.5	7214.07	7766.8767
840.67	15221.97	16040.73	15037.46	15433.387	916.74	8375.01	8906.42	7843.6	8375.01
842.15	15342.29	16171.28	15202.17	15571.913	918.21	9029.18	9551.35	8441.74	9007.4233
843.63	15406.16	16256.8	15370.71	15677.89	919.68	9101.48	9703.79	8432.25	9079.1733
845.11	15558.09	16404.55	15438.87	15800.503	921.14	8871.33	9442.94	8231.13	8848.4667
846.59	15549.25	16382.24	15537.18	15822.89	922.61	8610.94	9172.52	8049.35	8610.9367
848.07	15398.36	16217.81	15324.98	15647.05	924.08	8285.82	8860.56	7615.29	8253.89
849.54	15112.07	15942	15012.97	15355.68	925.55	7226.09	7717.66	6685.36	7209.7033
851.02	14953.16	15705.84	14815.17	15158.057	927.02	5870.77	6299.11	5316.45	5828.7767
852.49	14645.88	15384.55	14531.26	14853.897	928.49	4656.67	4915.37	4216.87	4596.3033
853.96	14373.06	15221.56	14257.36	14617.327	929.97	3620.55	3940.02	3114.74	3558.4367
855.43	14694.97	15475.23	14577.93	14916.043	931.44	2932.17	3096.59	2575.92	2868.2267
856.9	14994.38	15899.55	14902.55	15265.493	932.92	2640.89	2865.65	2388.04	2631.5267
858.37	15158.28	16015.8	15118.7	15430.927	934.4	2672.68	2845.11	2414.03	2643.94
859.83	15139.89	16039.02	15086.99	15421.967	935.88	3099.52	3245.72	2719.39	3021.5433
861.3	15201.33	16022.3	15121.88	15448.503	937.36	3564.04	3771.94	3148.23	3494.7367
862.76	15079.42	15898.81	15000.13	15326.12	938.84	3651.09	3801.96	3228.65	3560.5667
864.23	14648.87	15493.49	14596.08	14912.813	940.32	3429.05	3707.08	3058.34	3398.1567

941.81	3341.33	3625.03	2868.5	3278.2867	1020.8	11495.59	12254.74	10302.65	11350.993
943.29	3249.9	3442.96	2863.77	3185.5433	1022.33	11214.68	12007.64	10761.57	11327.963
944.78	3307.46	3438.45	2979.99	3241.9667	1023.86	10840.8	11901.32	10487.3	11076.473
946.27	3434.32	3701.07	2834.15	3323.18	1025.39	11099.81	11963.13	10853.15	11305.363
947.76	3523.74	3794.8	2913.86	3410.8	1026.91	11036.24	12319.53	11292.9	11549.557
949.25	3450.07	3760.58	3174.07	3461.5733	1028.44	11786.73	11920.67	10983.09	11563.497
950.74	3646.46	3786.71	3085.47	3506.2133	1029.96	11494.3	12475.52	11354.12	11774.647
952.24	3488.11	3879.63	3238.96	3535.5667	1031.48	11569.38	12301.62	10690.69	11520.563
953.74	3904.58	4085.34	3253.81	3747.91	1033	11174.13	12551.76	11327.2	11684.363
955.23	4006.82	4337.66	3528.94	3957.8067	1034.51	11335.63	12612.89	11175.98	11708.167
956.73	4170.19	4356.36	3723.39	4083.3133	1036.02	11522.31	13025.22	11021.34	11856.29
958.24	4309.43	4574.04	3704.6	4196.0233	1037.53	11848.11	12370.82	11499.64	11906.19
959.74	4680.45	4872.27	4181.71	4578.1433	1039.03	11304.18	12580.46	11121.85	11668.83
961.24	4941.39	5408.29	4318.85	4889.51	1040.54	11663.69	12810.94	10898.86	11791.163
962.75	5209.73	5564.94	4617.72	5130.7967	1042.03	12145.83	13340.5	10951.16	12145.83
964.26	5815.94	6257.14	5254.4	5775.8267	1043.53	11253.11	12711.84	11461.5	11808.817
965.77	6617.88	7186.28	6008.87	6604.3433	1045.02	12226.95	12445.29	11790.27	12154.17
967.28	7387.53	7841.51	6892.28	7373.7733	1046.5	11837.57	13203.44	11609.92	12216.977
968.79	7784.88	8370.83	7282.63	7812.78	1047.98	12587.26	13537.25	11399.79	12508.1
970.3	7658.47	8339.23	7105.36	7701.02	1049.46	13405.46	13157.21	12660.71	13074.46
971.82	7409.11	7799.06	6715.86	7308.01	1050.93	11394.15	13983.73	11135.19	12171.023
973.34	7192.89	7898.94	6751.61	7281.1467	1052.39	12413.95	13763.29	11334.48	12503.907
974.85	7309.33	7802.6	6771.22	7294.3833	1053.85	14172.22	13888.77	11904.66	13321.883
976.37	7752.35	8436.38	6840.31	7676.3467	1055.3	12103.82	14170.33	12989.47	13087.873
977.9	7903.09	8507.45	7252.25	7887.5967	1056.75	13793.53	14406.58	11341.35	13180.487
979.42	8437	8863.59	7773.42	8358.0033	1058.19	12537.09	15108.81	11894.17	13180.023
980.94	8881.43	9460.66	8109.14	8817.0767	1059.62	12638.61	13636.39	12638.61	12971.203
982.47	9154.77	9745.4	8514.92	9138.3633	1061.05	13286.1	13985.37	12237.2	13169.557
983.99	9645	10147.34	9042.19	9611.51	1062.46	12432.94	14626.99	13529.96	13529.963
985.52	9953.39	10569.06	9389.02	9970.49	1063.87	13742.22	14123.95	13360.49	13742.22
987.05	10184.32	10919.27	9554.36	10219.317	1065.27	13518.24	14711.02	13518.24	13915.833
988.58	10265.01	11017.42	9512.6	10265.01	1066.67	14268.23	13860.57	13860.57	13996.457
990.11	10612.7	10997.61	10062.82	10557.71	1068.05	13772.39	12937.7	11268.32	12659.47
991.64	10742.14	11307.51	10233.3	10760.983	1069.42	13252.93	14107.96	13252.93	13537.94
993.17	10717.28	11528.32	10195.9	10813.833	1070.79	13427.22	16026.04	13427.22	14293.493
994.71	10889.66	11841.76	10413.61	11048.343	1072.14	13106.04	14853.51	13542.91	13834.153
996.24	10701.31	11435.12	10395.56	10843.997	1073.48	14542.18	15864.2	14982.86	15129.747
997.77	10782.19	11854.11	10214.71	10950.337	1074.82	12800.7	15890.52	12359.3	13683.507
999.31	10619.02	11719.77	10619.02	10985.937	1076.14	13738.9	14625.28	11966.14	13443.44
1000.85	10922.47	11592.56	9984.34	10833.123	1077.44	13349.97	13794.97	13349.97	13498.303
1002.38	10869.65	11561.98	10315.78	10915.803	1078.74	12631.98	16241.12	12631.98	13835.027
1003.92	10713.59	11356.4	10213.62	10761.203	1080.02	13332.09	14251.54	14251.54	13945.057
1005.45	10658.04	11842.27	10213.96	10904.757	1081.3	13061.86	15860.83	12128.87	13683.853
1006.99	10572.92	11568.92	10419.69	10853.843	1082.55	14714.98	15664.34	12816.28	14398.533
1008.53	10944.46	11578.92	10706.54	11076.64	1083.79	13778.25	17714.89	12794.09	14762.41
1010.06	10713.03	11701.93	10548.22	10987.727	1085.02	13569.08	15076.75	13066.52	13904.117
1011.6	10956.07	11726.42	10356.91	11013.133	1086.24	15015.59	12426.69	13462.25	13634.843
1013.13	11104	12081.15	10659.84	11281.663	1087.43	15529.4	16064.9	12851.92	14815.407
1014.67	10899.67	11638.63	10530.19	11022.83	1088.62	13268.03	13820.86	16032.2	14373.697
1016.2	11035.68	11995.3	10651.83	11227.603	1089.78	13796.95	16671.31	12647.2	14371.82
1017.74	11106.18	11906.62	10705.96	11239.587					
1019.27	11134.53	12279.2	10510.16	11307.963					

APPENDIX C-3B

TOTAL WATER RADIANCE CALCULATION

AUGUST 14, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0	0	0	0
115.33	0.01	0.01	0.01	0.01
122.58	0.01	0.01	0.01	0.01
129.71	0.01	0.01	0.01	0.01
136.72	0.01	0.01	0.01	0.01
143.6	0.01	0.01	0.01	0.01
150.37	0.01	0.01	0.01	0.01
157.02	0.01	0.01	0.01	0.01
163.55	0.01	0.01	0.01	0.01
169.97	0.01	0.01	0.01	0.01
176.28	0.01	0.01	0.01	0.01
182.48	0.01	0.01	0.01	0.01
188.57	0.01	0.01	0.01	0.01
194.55	0.01	0.01	0.01	0.01
200.43	0.01	0.01	0.01	0.01
206.21	0.01	0.01	0.01	0.01
211.88	0.01	0.01	0.01	0.01
217.46	0.01	0.01	0.01	0.01
222.94	0.01	0.01	0.01	0.01
228.33	0.02	0.01	0.01	0.0133333
233.62	0.02	0.02	0.01	0.0166667
238.82	0.02	0.01	0.01	0.0133333
243.92	0.02	0.02	0.01	0.0166667
248.94	0.02	0.02	0.01	0.0166667
253.87	0.02	0.02	0.02	0.02
258.72	0.03	0.03	0.03	0.03
263.48	0.06	0.05	0.05	0.0533333
268.16	0.08	0.08	0.07	0.0766667
272.75	0.13	0.11	0.1	0.1133333
277.27	0.17	0.15	0.14	0.1533333
281.71	0.33	0.29	0.29	0.3033333
286.07	0.7	0.67	0.6	0.6566667
290.36	1.08	0.98	0.92	0.9933333
294.57	1.55	1.45	1.27	1.4233333
298.71	2.13	1.9	1.89	1.9733333
302.78	5.04	4.46	4.37	4.6233333
306.78	9.62	8.59	7.86	8.69
310.71	14.7	13.35	12.72	13.59
314.57	22.49	19.69	17.6	19.926667
318.37	30.95	28.18	26.46	28.53
322.1	53.92	48.76	46.44	49.706667
325.77	94.2	84.67	79.33	86.066667
329.38	142.92	134.08	121.8	132.93333
332.93	253.69	235.57	213.83	234.36333
336.42	381.4	354.5	331.44	355.78
339.85	515.9	485.02	443.84	481.58667
343.22	643.21	606.78	548.99	599.66
346.53	770.97	727.91	668.71	722.53
349.79	895.38	844.86	771.88	837.37333
353	1039.51	980.37	902	973.96
356.16	1135.65	1067.42	970.38	1057.8167
359.26	1215.83	1149.65	1051.15	1138.8767
362.32	1332.68	1262.87	1143.41	1246.32
365.32	1492.72	1404.09	1287.47	1394.76
368.28	1646.38	1558.1	1428	1544.16
371.19	1811.78	1717.66	1563.93	1697.79
374.05	1977.3	1867.99	1716.88	1854.0567
376.87	2116.76	2008.21	1835.52	1986.83
379.64	2262.73	2140.65	1968.39	2123.9233
382.37	2537.83	2382.94	2190.6	2370.4567
385.06	2929.77	2754.81	2523.24	2735.94
387.71	3374.34	3165.16	2906.25	3148.5833
390.32	3795.95	3558.17	3260.95	3538.3567
392.89	4131.76	3893.62	3570.43	3865.27
395.42	4332.68	4085.2	3744.48	4054.12
397.92	4468.31	4214.38	3869.62	4184.1033
400.37	4605.98	4337.01	3991.18	4311.39
402.8	4825.29	4522.98	4155.16	4501.1433
405.18	5014.45	4706	4331.81	4684.0867
407.54	5198.9	4869	4491.72	4853.2067
409.86	5346.24	5014.11	4622.67	4994.34
412.15	5484.35	5133.38	4733	5116.91
414.4	5572.25	5199.97	4814.03	5195.4167
416.63	5633.46	5252.89	4868.91	5251.7533
418.83	5701.4	5312.9	4914.18	5309.4933
420.99	5747.06	5332.33	4951.45	5343.6133
423.13	5782.56	5366.15	4981.77	5376.8267
425.25	5783.92	5364.18	4989.78	5379.2933
427.33	5766.09	5358.27	4982.08	5368.8133
429.39	5700.25	5294.86	4933.96	5309.69
431.43	5658.98	5251.49	4894.74	5268.4033
433.44	5816.69	5370.74	5013.99	5400.4733
435.42	6131.3	5643.11	5273.75	5682.72
437.38	6435.45	5929.28	5548.85	5971.1933
439.32	6612.62	6100.56	5701.95	6138.3767
441.24	6721.4	6202.68	5810.9	6244.9933
443.14	6842.49	6302.54	5909.7	6351.5767
445.02	7048.9	6480.8	6086.41	6538.7033
446.87	7300.36	6708.31	6297.95	6768.8733
448.71	7442.14	6849.6	6442.52	6911.42
450.53	7559.94	6949.36	6537.05	7015.45
452.33	7750.42	7117.54	6703.5	7190.4867
454.11	7961.09	7305.65	6903.28	7390.0067
455.88	8131.49	7456.99	7038.55	7542.3433
457.63	8146.69	7474.84	7065.89	7562.4733
459.36	8168.75	7476.94	7073.64	7573.11
461.08	8271.77	7558.91	7156.64	7662.44
462.78	8372.47	7648.77	7254.41	7758.55

464.47	8401.25	7681.23	7282.31	7788.2633	542.3	9941.11	9239.93	9069.08	9416.7067
466.15	8447.77	7725.55	7332.37	7835.23	543.74	10063.3	9356	9183.26	9534.1867
467.81	8514.94	7777.15	7391.73	7894.6067	545.18	10137.91	9435.59	9268.59	9614.03
469.46	8492.17	7768.73	7397.42	7886.1067	546.62	10207.78	9501.36	9336.26	9681.8
471.1	8439.93	7727.68	7355.77	7841.1267	548.07	10268.39	9571.11	9411.04	9750.18
472.72	8406.19	7693.61	7333.88	7811.2267	549.51	10330.04	9633.07	9481.64	9814.9167
474.33	8425.63	7715.84	7358.16	7833.21	550.96	10371.41	9677.73	9532.25	9860.4633
475.94	8451.4	7740.91	7390.58	7860.9633	552.41	10408.9	9727.15	9594.33	9910.1267
477.53	8540.43	7818.1	7476.77	7945.1	553.86	10406.91	9734.51	9613.56	9918.3267
479.11	8631.1	7904.72	7564.32	8033.38	555.32	10357.4	9704.21	9586	9882.5367
480.68	8695.87	7938.54	7615.99	8083.4667	556.77	10331.78	9676.05	9564.05	9857.2933
482.24	8714.43	7962.24	7636.24	8104.3033	558.23	10364.18	9718.72	9616.11	9899.67
483.8	8745.06	7979.85	7657.65	8127.52	559.69	10405.66	9768.79	9680.19	9951.5467
485.34	8767.33	8001.58	7681.95	8150.2867	561.16	10423.24	9790.53	9704.4	9972.7233
486.88	8759.35	7984.48	7675.86	8139.8967	562.62	10405.04	9762.92	9681.58	9949.8467
488.41	8662	7901.5	7593.43	8052.31	564.09	10377.19	9735.37	9657.37	9923.31
489.93	8415.38	7682.85	7393.09	7830.44	565.56	10314.22	9691.7	9613.17	9873.03
491.45	8168.73	7467.12	7184.5	7606.7833	567.03	10237.47	9616.42	9543.28	9799.0567
492.95	8241.85	7503.24	7234.1	7659.73	568.51	10247.82	9602.17	9538.43	9796.14
494.46	8425.91	7680.44	7408.06	7838.1367	569.99	10280.58	9621.44	9555.65	9819.2233
495.95	8457.58	7725.62	7460.54	7881.2467	571.47	10253.25	9604.83	9517.01	9791.6967
497.44	8453.89	7713.29	7448.02	7871.7333	572.95	10196.46	9549.07	9452.44	9732.6567
498.93	8493.12	7759.49	7504.84	7919.15	574.44	10148.77	9496.38	9398.7	9681.2833
500.41	8519.59	7791.66	7546.56	7952.6033	575.93	10097.5	9452.54	9349.45	9633.1633
501.88	8487.76	7766.78	7517.69	7924.0767	577.42	10044.6	9398.98	9275.32	9572.9667
503.35	8421.71	7712.49	7484.98	7873.06	578.92	9952.89	9291.4	9158.63	9467.64
504.82	8347.22	7661.06	7434.48	7814.2533	580.42	9769.95	9103.45	8974.08	9282.4933
506.28	8373.11	7676	7466.99	7838.7	581.92	9511.88	8857.93	8730.77	9033.5267
507.74	8461.84	7748.78	7540.97	7917.1967	583.42	9145.06	8509.97	8388.09	8681.04
509.2	8604.23	7884.84	7674.85	8054.64	584.93	8806.77	8179.29	8063.7	8349.92
510.65	8652.5	7939.57	7728.37	8106.8133	586.44	8656.26	8025.39	7907.03	8196.2267
512.1	8690.6	7965.33	7759.19	8138.3733	587.95	8595.37	7958.51	7838.03	8130.6367
513.55	8736.72	8019.83	7805.86	8187.47	589.47	8476.64	7837.31	7715.64	8009.8633
514.99	8745.94	8029.89	7819.14	8198.3233	590.99	8345.29	7702.93	7571.06	7873.0933
516.44	8697.68	7995.76	7786.24	8159.8933	592.51	8219.51	7561.56	7429.76	7736.9433
517.88	8646.98	7948.7	7743.52	8113.0667	594.03	8071.6	7396.92	7275.03	7581.1833
519.32	8549.51	7864.8	7660.16	8024.8233	595.56	7920.25	7244.97	7112.5	7425.9067
520.76	8618.53	7929.61	7733.24	8093.7933	597.09	7801.67	7105.91	6975.05	7294.21
522.2	8860.99	8160.96	7959.11	8327.02	598.62	7704.42	7006.64	6891.09	7200.7167
523.63	9049.93	8349.91	8146.54	8515.46	600.16	7617.17	6917.81	6810.3	7115.0933
525.07	9179.26	8479.02	8272.05	8643.4433	601.7	7506.77	6824.76	6712.82	7014.7833
526.5	9231.01	8552.05	8352.49	8711.85	603.24	7396.48	6725.13	6618.52	6913.3767
527.94	9225.76	8558.84	8349.74	8711.4467	604.79	7290.04	6625.9	6523.73	6813.2233
529.37	9359.06	8687.75	8470.33	8839.0467	606.34	7210.5	6541.21	6444.91	6732.2067
530.81	9536.38	8869.88	8657.61	9021.29	607.89	7143.65	6467.52	6378.91	6663.36
532.24	9626.21	8955.11	8750.04	9110.4533	609.44	7076.41	6393.41	6306.35	6592.0567
533.67	9653.53	8975.51	8764.51	9131.1833	611	7028.42	6332.12	6255.58	6538.7067
535.11	9735.14	9042.35	8845.1	9207.53	612.56	6999.06	6312.44	6230.49	6513.9967
536.55	9805.09	9116.61	8917.47	9279.7233	614.12	6967.36	6291.3	6204.14	6487.6
537.98	9828.58	9142.44	8953.88	9308.3	615.69	6907.32	6222.7	6146.63	6425.55
539.42	9803.62	9120.24	8938.49	9287.45	617.25	6836.87	6150.57	6069.76	6352.4
540.86	9841.26	9151.78	8968	9320.3467	618.82	6753.54	6070.89	5994.21	6272.88

620.4	6698.64	6017.61	5934.17	6216.8067	704.45	4355.28	3729.68	3666.82	3917.26
621.97	6643.93	5957.76	5885.98	6162.5567	706.08	4263.26	3631.61	3578.84	3824.57
623.55	6592.44	5916.11	5834.27	6114.2733	707.71	4148.32	3517.82	3469.31	3711.8167
625.13	6577.42	5901.16	5813.94	6097.5067	709.34	4006.7	3372.7	3339.17	3572.8567
626.71	6583.11	5902.14	5808.42	6097.89	710.97	3776.69	3167.7	3138.55	3360.98
628.3	6579.05	5903.06	5812.06	6098.0567	712.6	3416.67	2847.48	2838.23	3034.1267
629.89	6561.55	5882.85	5791.96	6078.7867	714.23	2959.17	2465.98	2467.52	2630.89
631.47	6557.34	5862.9	5764.03	6061.4233	715.86	2640.92	2163.72	2179.27	2327.97
633.07	6566.81	5869.14	5772.41	6069.4533	717.49	2590.71	2100.87	2127.31	2272.9633
634.66	6550.13	5855.86	5758.96	6054.9833	719.11	2644.68	2139.74	2169.35	2317.9233
636.26	6513.08	5825.54	5725.38	6021.3333	720.74	2605.73	2097.98	2140.03	2281.2467
637.86	6458.71	5774.71	5685.01	5972.81	722.36	2478.73	1982.36	2015.14	2158.7433
639.46	6374.81	5690.68	5605.16	5890.2167	723.99	2404.63	1905.29	1944.3	2084.74
641.06	6228.16	5578.52	5483.17	5763.2833	725.61	2376.21	1873.73	1914.43	2054.79
642.66	6092.52	5469.45	5363.26	5641.7433	727.23	2362.11	1858.3	1889.69	2036.7
644.27	6019.54	5392.69	5285.64	5565.9567	728.85	2423.66	1884.37	1917.48	2075.17
645.88	5962.76	5306.59	5215.46	5494.9367	730.47	2545.63	1972.54	1997.87	2172.0133
647.49	5867.56	5197.96	5125.75	5397.09	732.08	2645.84	2056.81	2072.73	2258.46
649.1	5692.84	5032.41	4962.41	5229.22	733.7	2694	2085.01	2099.43	2292.8133
650.71	5509.75	4865.56	4791.9	5055.7367	735.32	2716.96	2094.56	2104.24	2305.2533
652.32	5438.42	4786.79	4732.48	4985.8967	736.93	2754.53	2127.62	2140.61	2340.92
653.94	5441.5	4769.08	4735.94	4982.1733	738.54	2796.24	2155.36	2161.92	2371.1733
655.56	5419.11	4746.44	4712.88	4959.4767	740.15	2850.96	2201.44	2194.83	2415.7433
657.18	5363.33	4696.99	4650.21	4903.51	741.76	2899.54	2239.65	2237.98	2459.0567
658.8	5287.75	4620.35	4593.2	4833.7667	743.37	2929.55	2259.46	2245.99	2478.3333
660.42	5234.36	4563.88	4546.62	4781.62	744.97	2950	2263.08	2263.08	2492.0533
662.04	5201.34	4519.34	4515.02	4745.2333	746.58	2952.72	2263.93	2257.06	2491.2367
663.66	5182.94	4492.84	4489.98	4721.92	748.18	2932.9	2251.8	2250.07	2478.2567
665.29	5183.47	4486.87	4495.36	4721.9	749.78	2912.98	2246.16	2242.65	2467.2633
666.92	5225.23	4525.34	4523.93	4758.1667	751.38	2912.63	2246.48	2228.77	2462.6267
668.54	5275.96	4569.57	4579.48	4808.3367	752.98	2903.66	2234.27	2221.71	2453.2133
670.17	5334.99	4628.97	4647.47	4870.4767	754.57	2878.38	2195.04	2195.04	2422.82
671.8	5399.83	4694.89	4713.44	4936.0533	756.16	2703.4	2079.26	2077.42	2286.6933
673.43	5459.56	4749.19	4783.56	4997.4367	757.76	2276.74	1748.77	1765.45	1930.32
675.06	5520	4809.03	4844.87	5057.9667	759.35	1764.09	1354.97	1366.24	1495.1
676.69	5553.49	4850.5	4877.81	5093.9333	760.93	1510.8	1130.74	1142.08	1261.2067
678.32	5549.56	4848.85	4883.38	5093.93	762.52	1580.27	1181.39	1200.47	1320.71
679.95	5461.55	4776.69	4814.18	5017.4733	764.1	1829.6	1376.52	1386.12	1530.7467
681.58	5254.23	4612.44	4648.58	4838.4167	765.69	2154.33	1616.71	1637.91	1802.9833
683.22	5043.62	4440.88	4456.82	4647.1067	767.27	2447.32	1856.32	1867.94	2057.1933
684.85	4989.7	4389.02	4399.18	4592.6333	768.85	2629.18	2002.54	2000.59	2210.77
686.48	5029.03	4415.7	4420.07	4621.6	770.42	2720.8	2074.76	2070.85	2288.8033
688.12	4996.54	4396.08	4385.86	4592.8267	772	2764.34	2097.76	2095.8	2319.3
689.75	4928.57	4329.88	4316.7	4525.05	773.57	2771.89	2112.39	2100.57	2328.2833
691.38	4916.53	4312.8	4277.54	4502.29	775.14	2774.82	2116.12	2120.07	2337.0033
693.02	4928.61	4309.77	4271.46	4503.28	776.7	2786.83	2105.47	2117.35	2336.55
694.65	4846.95	4242.18	4189.08	4426.07	778.27	2771.41	2110.33	2110.33	2330.69
696.29	4689.36	4098.75	4042.5	4276.87	779.83	2768.33	2107.12	2107.12	2327.5233
697.92	4579.06	3983.53	3919.83	4160.8067	781.4	2762.57	2106.33	2108.33	2325.7433
699.55	4536.05	3922.63	3861.73	4106.8033	782.96	2762.16	2083.14	2099.16	2314.82
701.19	4486.69	3880.34	3822.38	4063.1367	784.51	2723.05	2074.42	2082.45	2293.3067
702.82	4437.47	3815.72	3754.44	4002.5433	786.07	2670.74	2030.25	2042.33	2247.7733

787.62	2612.61	1981.7	1999.9	2198.07	865.69	2044.8	1496.68	1509.81	1683.7633
789.17	2546.75	1924.8	1955.29	2142.28	867.15	2067.75	1501.74	1541	1703.4967
790.72	2529.85	1914.76	1924.97	2123.1933	868.62	2107.9	1538.64	1554.9	1733.8133
792.27	2523.57	1902.44	1929.18	2118.3967	870.08	2114.42	1566.35	1572.84	1751.2033
793.81	2527.96	1917.19	1944.11	2129.7533	871.54	2123.04	1561.63	1574.53	1753.0667
795.35	2521.19	1909.68	1932.63	2121.1667	873	2111.18	1539.81	1565.63	1738.8733
796.89	2501.73	1890.47	1924.08	2105.4267	874.46	2104.9	1547.25	1556.92	1736.3567
798.43	2497.4	1898.03	1919.28	2104.9033	875.91	2094.32	1548.12	1554.58	1732.34
799.97	2467.9	1874.49	1913.05	2085.1467	877.37	2084.89	1528.06	1547.48	1720.1433
801.5	2445.22	1856.64	1884.77	2062.21	878.83	2064.68	1534.69	1534.69	1711.3533
803.03	2425.27	1850.11	1876.36	2050.58	880.29	2059.26	1519.07	1505.98	1694.77
804.56	2463.16	1863.95	1897.12	2074.7433	881.74	2028.26	1493.98	1503.88	1675.3733
806.09	2481.01	1884.76	1927.19	2097.6533	883.2	2040	1490.9	1517.52	1682.8067
807.61	2456.75	1863.51	1904.27	2074.8433	884.66	2025.2	1470.12	1480.21	1658.51
809.14	2400.22	1812.74	1853.88	2022.28	886.11	1999.82	1462.45	1476.06	1646.11
810.66	2276.74	1723.19	1764.87	1921.6	887.57	1991.72	1450.71	1467.94	1636.79
812.17	2108.91	1592.78	1639.49	1780.3933	889.03	1946.11	1425.52	1442.99	1604.8733
813.69	1898.87	1440.11	1477.95	1605.6433	890.48	1867.07	1355.94	1359.48	1527.4967
815.21	1738.82	1296.34	1348.96	1461.3733	891.94	1702.79	1251.84	1277.09	1410.5733
816.72	1647.49	1229.58	1287.55	1388.2067	893.39	1535.68	1104.81	1152.68	1264.39
818.23	1677.93	1245.62	1294.47	1406.0067	894.85	1359.85	974	1015.21	1116.3533
819.74	1745.21	1313.23	1360.13	1472.8567	896.31	1242.84	879.55	913.96	1012.1167
821.25	1764.83	1318.01	1375.42	1486.0867	897.76	1176.64	836.55	867.82	960.33667
822.75	1729.34	1293.23	1348.69	1457.0867	899.22	1162.97	819.28	867.23	949.82667
824.25	1771.99	1323.26	1358.95	1484.7333	900.68	1224.14	897.7	930.35	1017.3967
825.75	1840.04	1373.58	1417.4	1543.6733	902.14	1326.65	963.7	1005.42	1098.59
827.25	1826.89	1366.27	1413.11	1535.4233	903.59	1333.68	966.06	1021.63	1107.1233
828.75	1790.98	1329.39	1368.95	1496.44	905.05	1249.43	891.2	934.89	1025.1733
830.25	1793.93	1332.79	1356.78	1494.5	906.51	1138.32	797.72	847.02	927.68667
831.74	1809.7	1338.43	1378.82	1508.9833	907.97	1102.69	790.26	813.23	902.06
833.23	1851.53	1366.15	1412.51	1543.3967	909.43	1076.1	780.05	822.34	892.83
834.72	1925.79	1415.37	1442.96	1594.7067	910.89	1053.88	741.09	784.4	859.79
836.21	1986.6	1473.93	1493.43	1651.32	912.35	1021.77	715.73	755.22	830.90667
837.7	2039.69	1509.32	1540.35	1696.4533	913.82	1025.95	702.5	747.99	825.48
839.18	2079.8	1540.59	1574.83	1731.74	915.28	1046.87	746.28	798.11	863.75333
840.67	2116.08	1559.68	1588.5	1754.7533	916.74	1121.27	807.74	834.31	921.10667
842.15	2145.47	1579.18	1605.45	1776.7	918.21	1207.52	875.72	913.8	999.01333
843.63	2156.15	1600.87	1618.59	1791.87	919.68	1187.88	892.3	948.07	1009.4167
845.11	2181.71	1618.4	1645.22	1815.11	921.14	1166.08	828.83	908.85	967.92
846.59	2194.16	1623.74	1647.88	1821.9267	922.61	1158.26	789.73	859.92	935.97
848.07	2167.88	1602.21	1611.39	1793.8267	924.08	1089.61	772.31	838.16	900.02667
849.54	2124.36	1570.05	1591.72	1762.0433	925.55	903.26	657.48	737.36	766.03333
851.02	2073	1530.44	1564.94	1722.7933	927.02	762.19	510.23	566.92	613.11333
852.49	2040.87	1512.35	1521.9	1691.7067	928.49	588.55	420.39	472.13	493.69
853.96	2002.33	1484.87	1494.52	1660.5733	929.97	465.88	339.43	352.74	386.01667
855.43	2061.2	1515.01	1521.51	1699.24	931.44	417.9	287.74	301.44	335.69333
856.9	2118.63	1554.54	1590.61	1754.5933	932.92	386.3	231.78	266.9	294.99333
858.37	2120.71	1573.22	1589.71	1761.2133	934.4	380.79	273.02	280.2	311.33667
859.83	2132.15	1580.1	1606.55	1772.9333	935.88	416.68	285.1	336.27	346.01667
861.3	2135.2	1565.82	1582.37	1761.13	937.36	460.35	319.28	371.25	383.62667
862.76	2124.47	1562.79	1595.83	1761.03	938.84	497.88	354.55	384.72	412.38333
864.23	2081.86	1530.87	1544.07	1718.9333	940.32	432.49	308.92	378.43	373.28

941.81	433.43	299.46	338.86	357.25	1020.8	1680.96	1138.71	1247.16	1355.61
943.29	418.3	289.59	345.9	351.26333	1022.33	1670.87	1331.04	1331.04	1444.3167
944.78	450.27	302.91	343.84	365.67333	1023.86	1738.06	1237.27	1266.72	1414.0167
946.27	433.46	316.76	366.77	372.33	1025.39	1572.47	1325.81	1264.15	1387.4767
947.76	474.35	364.23	355.76	398.11333	1026.91	1668.27	1251.2	1411.61	1443.6933
949.25	483.01	319.13	327.76	376.63333	1028.44	1607.28	1305.92	1372.89	1428.6967
950.74	464.57	306.79	359.39	376.91667	1029.96	1541.92	1436.79	1471.83	1483.5133
952.24	498.3	338.13	373.73	403.38667	1031.48	1684.15	1208.19	1281.42	1391.2533
953.74	515.19	361.53	397.69	424.80333	1033	1683.77	1415.9	1377.63	1492.4333
955.23	533.02	404.36	431.93	456.43667	1034.51	1756.22	1476.83	1436.91	1556.6533
956.73	530.58	390.96	437.5	453.01333	1036.02	1836.89	1419.42	1335.92	1530.7433
958.24	567.03	406.37	472.53	481.97667	1037.53	1742.37	1219.66	1393.9	1451.9767
959.74	585.06	402.83	441.19	476.36	1039.03	1914.42	1276.28	1504.19	1564.9633
961.24	680.9	418.27	515.54	538.23667	1040.54	1768.67	1386.26	1386.26	1513.73
962.75	690.68	503.21	513.08	568.99	1042.03	1941.34	1344.01	1493.34	1592.8967
964.26	762.09	541.48	591.62	631.73	1043.53	1667.13	1458.74	1458.74	1528.2033
965.77	852.61	639.46	720.66	737.57667	1045.02	1965.05	1528.37	1419.2	1637.54
967.28	990.51	711.93	784.15	828.86333	1046.5	1593.52	1536.61	1479.7	1536.61
968.79	1004.5	721.98	826.62	851.03333	1047.98	1781.22	1424.97	1484.35	1563.5133
970.3	989.22	744.57	755.21	829.66667	1049.46	2048.06	1551.56	1489.5	1696.3733
971.82	1007.38	714.91	769.07	830.45333	1050.93	2006.92	1618.49	1424.27	1683.2267
973.34	959.79	706.05	750.18	805.34	1052.39	1956.55	1214.41	1686.68	1619.2133
974.85	986.54	695.06	751.11	810.90333	1053.85	2338.42	1346.36	1700.67	1795.15
976.37	1026.05	741.03	798.04	855.04	1055.3	2066.51	1623.68	1549.88	1746.69
977.9	1104.11	767.07	801.93	891.03667	1056.75	1992.4	1609.25	1609.25	1736.9667
979.42	1125.72	782.08	865.03	924.27667	1058.19	1928.78	1366.22	1607.32	1634.1067
980.94	1218.78	868.84	929.17	1005.5967	1059.62	2078.72	1662.97	1662.97	1801.5533
982.47	1267.39	959.77	996.69	1074.6167	1061.05	2097.81	1573.35	1835.58	1835.58
983.99	1318.65	992.13	1042.36	1117.7133	1062.46	2102.63	1828.37	1736.95	1889.3167
985.52	1372.44	987.64	1026.12	1128.7333	1063.87	2576.67	1240.62	1813.21	1876.8333
987.05	1338.66	1049.93	1089.3	1159.2967	1065.27	2186.77	1789.18	1590.38	1855.4433
988.58	1437.64	1034.56	1101.74	1191.3133	1066.67	2445.98	1528.74	1732.57	1902.43
990.11	1470.93	1099.76	1113.51	1228.0667	1068.05	2295.4	1773.72	2191.06	2086.7267
991.64	1441.71	1045.94	1173.15	1220.2667	1069.42	2244.45	1816.93	1389.42	1816.9333
993.17	1535.18	1100.69	1129.66	1255.1767	1070.79	2165.68	1407.69	2382.25	1985.2067
994.71	1547.16	1160.37	1190.13	1299.22	1072.14	2075.12	1965.91	1747.47	1929.5
996.24	1559.33	1161.86	1146.57	1289.2533	1073.48	2423.7	1432.18	1762.69	1872.8567
997.77	1513.29	1166.49	1261.08	1313.62	1074.82	2427.72	1765.61	2096.67	2096.6667
999.31	1537.82	1149.31	1165.5	1284.21	1076.14	2215.95	1661.96	2105.15	1994.3533
1000.85	1541.21	1122.4	1155.91	1273.1733	1077.44	2225	1557.5	2336.24	2039.58
1002.38	1557.75	1142.35	1194.28	1298.1267	1078.74	2706.85	1917.35	1691.78	2105.3267
1003.92	1535.61	1124.93	1124.93	1261.8233	1080.02	2643.43	2183.7	2298.64	2375.2567
1005.45	1572.8	1147.22	1202.73	1307.5833	1081.3	1982.6	1865.98	1982.6	1943.7267
1006.99	1589.77	1206.69	1110.92	1302.46	1082.55	2492.05	2254.72	2373.38	2373.3833
1008.53	1487.02	1149.96	1189.62	1275.5333	1083.79	2829.46	1599.26	1968.32	2132.3467
1010.06	1648.16	1112.51	1215.52	1325.3967	1085.02	2261.51	1758.95	2135.87	2052.11
1011.6	1583.49	1241.12	1155.52	1326.71	1086.24	2459.45	1941.67	3236.12	2545.7467
1013.13	1665.6	1177.02	1199.23	1347.2833	1087.43	2677.48	2141.99	2008.11	2275.86
1014.67	1662.66	1247	1247	1385.5533	1088.62	3040.59	1934.92	2211.34	2395.6167
1016.2	1607.37	1175.54	1247.51	1343.4733	1089.78	1868.34	2299.49	2012.05	2059.96
1017.74	1625.9	1250.7	1300.72	1392.44					
1019.27	1612.95	1144.67	1248.73	1335.45					

APPENDIX C-3C

DOWNWELLING IRRADIANCE CALCULATION

AUGUST 14, 2006

Wavelength (nm)	L_1	L_2	L_3	L_{AVE}
107.95	0.03	0.03	0.03	0.03
115.33	0.21	0.21	0.21	0.21
122.58	0.22	0.22	0.22	0.22
129.71	0.24	0.24	0.24	0.24
136.72	0.25	0.25	0.25	0.25
143.6	0.27	0.27	0.27	0.27
150.37	0.28	0.28	0.28	0.28
157.02	0.29	0.29	0.29	0.29
163.55	0.31	0.31	0.31	0.31
169.97	0.33	0.33	0.32	0.3266667
176.28	0.33	0.34	0.34	0.3366667
182.48	0.35	0.35	0.35	0.35
188.57	0.37	0.37	0.37	0.37
194.55	0.38	0.38	0.38	0.38
200.43	0.4	0.39	0.39	0.3933333
206.21	0.42	0.41	0.41	0.4133333
211.88	0.43	0.43	0.42	0.4266667
217.46	0.44	0.43	0.43	0.4333333
222.94	0.45	0.46	0.45	0.4533333
228.33	0.47	0.47	0.47	0.47
233.62	0.49	0.48	0.48	0.4833333
238.82	0.5	0.5	0.49	0.4966667
243.92	0.51	0.52	0.51	0.5133333
248.94	0.53	0.53	0.53	0.53
253.87	0.73	0.74	0.74	0.7366667
258.72	1.02	1.01	1.03	1.02
263.48	1.67	1.64	1.64	1.65
268.16	2.47	2.47	2.44	2.46
272.75	3.55	3.55	3.6	3.5666667
277.27	4.88	4.84	4.81	4.8433333
281.71	9.77	9.77	9.63	9.7233333
286.07	20.17	20.17	20.06	20.133333
290.36	31.4	31.4	31.06	31.286667
294.57	45.29	45.18	44.47	44.98
298.71	59.15	60.05	59.9	59.7
302.78	140.91	139.9	141.25	140.68667
306.78	261.37	263.13	259.61	261.37
310.71	403.71	403.71	401.21	402.87667
314.57	594.42	595.54	592.19	594.05
318.37	817.52	814.75	813.37	815.21333
322.1	1391.1	1382.85	1378.72	1384.2233
325.77	2361.47	2355.37	2355.37	2357.4033
329.38	3555.71	3555.71	3551.78	3554.4
332.93	6164.02	6129.23	6129.23	6140.8267
336.42	9338.06	9299.63	9315	9317.5633
339.85	12546.39	12518.94	12500.64	12521.99
343.22	15457.13	15507.38	15437.03	15467.18
346.53	18610.81	18589.28	18524.7	18574.93
349.79	21646.35	21635.13	21601.44	21627.64
353	24995.62	24983.79	24936.47	24971.96
356.16	27255.66	27304.18	27231.4	27263.747
359.26	29672.4	29573.9	29561.59	29602.63
362.32	32679.44	32617.38	32592.56	32629.793
365.32	36621.5	36609.06	36546.86	36592.473
368.28	40615.86	40578.69	40541.52	40578.69
371.19	44837.92	44850.47	44800.27	44829.553
374.05	49152.81	49139.95	49011.34	49101.367
376.87	52868.1	52854.94	52762.84	52828.627
379.64	57061.68	56954.65	56901.13	56972.487
382.37	64407.35	64380.11	64312.03	64366.497
385.06	74829.16	74829.16	74691.93	74783.417
387.71	86470.84	86470.84	86278.81	86406.83
390.32	97461.7	97339.41	97189.95	97330.353
392.89	106469.82	106429	106211.27	106370.03
395.42	112025.89	111930.96	111727.55	111894.8
397.92	116199.72	116024.83	115890.29	116038.28
400.37	120407.11	120273.46	120046.25	120242.27
402.8	126394.79	126367.92	126072.32	126278.34
405.18	132388.28	132280.41	131997.24	132221.98
407.54	137915.4	137807.13	137563.51	137762.01
409.86	142774.19	142570.85	142286.17	142543.74
412.15	146876.34	146726.41	146576.48	146726.41
414.4	149964.03	149827.42	149554.18	149781.88
416.63	152364.61	152118.86	151886.77	152123.41
418.83	154854.48	154690.9	154445.54	154663.64
420.99	156563.87	156387.82	156089.89	156347.19
423.13	158094.93	157879.14	157555.45	157843.17
425.25	158920.88	158732.84	158383.62	158679.11
427.33	159013.61	158787.23	158507.58	158769.47
429.39	157728.39	157491.09	157227.42	157482.3
431.43	156998.16	156814.87	156539.94	156784.32
433.44	161913.69	161706.12	161407.75	161675.85
435.42	171509.42	171303.87	170995.54	171269.61
437.38	180479.25	180275.51	179957.16	180237.31
439.32	186041.92	185802.44	185449.51	185764.62
441.24	189308.59	189145.61	188769.5	189074.57
443.14	192816.64	192603.79	192178.09	192532.84
445.02	199122.17	198909.33	198571.28	198867.59
446.87	206333.5	206057.84	205719.53	206036.96
448.71	210637.02	210310.1	209907.74	210284.95
450.53	213717.93	213503.91	213101.04	213440.96
452.33	218919.96	218630.29	218227.26	218592.5
454.11	225092.06	224790.27	224501.06	224794.46
455.88	229318.07	229005.8	228568.63	228964.17
457.63	229527.75	229158.77	228765.2	229150.57
459.36	229546.71	229268.78	228797.51	229204.33
461.08	232195.2	231899.41	231473.47	231856.03
462.78	234914.62	234510.15	234094.13	234506.3

464.47	235376.59	235037.09	234595.74	235003.14	542.3	213699.98	213396.26	213007.11	213367.78
466.15	236487.35	236074.66	235650.8	236070.94	543.74	214702.38	214347.56	214011.42	214353.79
467.81	237779.7	237372.26	236931.79	237361.25	545.18	214832.73	214448.4	214064.07	214448.4
469.46	236739.47	236377.75	235983.15	236366.79	546.62	214573.41	214223.01	213872.6	214223.01
471.1	234484.45	234067.26	233661.05	234070.92	548.07	214480.55	214059.55	213726.26	214088.79
472.72	233107.34	232710.39	232291.39	232703.04	549.51	214156.9	213821.84	213435.23	213804.66
474.33	233067.34	232677.65	232232.29	232659.09	550.96	213508.9	213196.85	212766.73	213157.49
475.94	233347.12	232964.44	232593.01	232968.19	552.41	212889.1	212515.53	212175.18	212526.6
477.53	235200.23	234814.99	234418.42	234811.21	553.86	211397.82	211012.42	210627.01	211012.42
479.11	237284.14	236862.55	236429.57	236858.75	555.32	209047.54	208656.23	208305.68	208669.82
480.68	238119.19	237675.87	237243.92	237679.66	556.77	207185.39	206810.69	206378.97	206791.68
482.24	238285.7	237856.69	237484.12	237875.5	558.23	206881.25	206528.25	206117.79	206509.1
483.8	238923.2	238467.68	237989.95	238460.28	559.69	207033.34	206658.1	206299.53	206663.66
485.34	239163.28	238728.05	238281.93	238724.42	561.16	206610.29	206261.5	205836.15	206235.98
486.88	238390.03	238040.35	237531.71	237987.36	562.62	205632.08	205284.99	204842.45	205253.17
488.41	235348.56	234987.64	234482.36	234939.52	564.09	204936.44	204562.05	204187.65	204562.05
489.93	228330.45	227939.09	227537.7	227935.75	565.56	204012.79	203630.4	203320.85	203654.68
491.45	221597.78	221332.37	220811.38	221247.18	567.03	202905.92	202525.16	202144.41	202525.16
492.95	223545.05	223187.81	222782.29	223171.72	568.51	203190.65	202803.49	202435.22	202809.79
494.46	228781.35	228351.27	227988.09	228373.57	569.99	204357.88	203888.95	203611.42	203952.75
495.95	229308.77	228964.88	228515.91	228929.85	571.47	204675.17	204270.96	203828.25	204258.13
497.44	228522.69	228138.58	227716.07	228125.78	572.95	204393.06	203967.9	203629.71	203996.89
498.93	229212.41	228785.57	228397.53	228798.5	574.44	204518.86	204123.33	203737.44	204126.54
500.41	229261.6	228916.73	228542.29	228906.87	575.93	204851.08	204553.78	204198.94	204534.6
501.88	227208.08	226777.5	226427.03	226804.2	577.42	205324.54	204944.06	204563.59	204944.06
503.35	224348.59	223982.54	223575.81	223968.98	578.92	204937.13	204579.95	204232.17	204583.08
504.82	221363.44	221002.98	220591.02	220985.81	580.42	203299.99	202958.07	202542.23	202933.43
506.28	220821.53	220385.35	220053.02	220419.97	581.92	200610.15	200265.01	199910.78	200261.98
507.74	221766.39	221329.99	220966.32	221354.23	583.42	196000.98	195670.02	195276.44	195649.15
509.2	223756.72	223383.41	222947.89	223362.67	584.93	192128.57	191776.3	191388.81	191764.56
510.65	223193.62	222763.55	222415.4	222790.86	586.44	192157.64	191792.8	191410.59	191787.01
512.1	222079.09	221646.7	221244.47	221656.75	587.95	193818.53	193525.92	193173.07	193505.84
513.55	221436.7	220974.35	220600.53	221003.86	589.47	194584.79	194243.25	193859.01	194229.02
514.99	219577.81	219290.43	218859.36	219242.53	590.99	195462.86	195088.51	194722.67	195091.35
516.44	216398.99	216045.12	215672.63	216038.91	592.51	196400.8	196077.67	195763.05	196080.51
517.88	212805.57	212406.55	211998.46	212403.53	594.03	197199.85	196840.59	196489.88	196843.44
519.32	208073.13	207683.76	207312.09	207689.66	595.56	197521.49	197133.77	196806.36	197153.87
520.76	207912.2	207617.11	207235.22	207588.18	597.09	197970.9	197525.96	197211.89	197569.58
522.2	212062.61	211727.62	211332.51	211707.58	598.62	198550.45	198186.01	197768.23	198168.23
523.63	214817.76	214440.99	213978.6	214412.45	600.16	198854.49	198519.52	198103.08	198492.36
525.07	215935.55	215600.98	215154.89	215563.81	601.7	198377.33	198054.21	197620.3	198017.28
526.5	215522.6	215192.89	214724.34	215146.61	603.24	197423.69	197048.77	196664.48	197045.65
527.94	213644.07	213168.64	212763.64	213192.12	604.79	196450.81	196127.66	195718.96	196099.14
529.37	214925.48	214611.68	214199.26	214578.81	606.34	195672.93	195287.73	195018.08	195326.25
530.81	217542.68	217150.09	216711.84	217134.87	607.89	195025.8	194676.21	194258.63	194653.55
532.24	217737.46	217345.98	216879.93	217321.12	609.44	194298.93	194043.88	193582.82	193975.21
533.67	216607.02	216151.84	215753.56	216170.81	611	194114.33	193719.27	193393.34	193742.31
535.11	216775.96	216381.46	215890.73	216349.38	612.56	194568.13	194190.67	193862.88	194207.23
536.55	216826.64	216506.07	216059.23	216463.98	614.12	194877.04	194488.58	194120.04	194495.22
537.98	215739.74	215350.44	214990.34	215360.17	615.69	194148.18	193729.17	193389.98	193755.78
539.42	213845.17	213467.13	213060.01	213457.44	617.25	192809.98	192521.54	192113.74	192481.75
540.86	213012.3	212637.53	212262.76	212637.53	618.82	191478.49	191102.54	190687.01	191089.35

620.4	190610.12	190188	189883.68	190227.27	704.45	169948.77	169553.65	169314.18	169605.53
621.97	189791.82	189421.97	189061.86	189425.22	706.08	170373.46	169975.48	169698.09	170015.68
623.55	189402.09	189074.76	188718.54	189065.13	707.71	170140.41	169849.4	169558.4	169849.4
625.13	189372.32	189009.1	188693.67	189025.03	709.34	168765.93	168327.01	168083.16	168392.03
626.71	189741.56	189390.4	189020.25	189384.07	710.97	164112.74	163769.13	163388.7	163756.86
628.3	190032.47	189663.75	189295.04	189663.75	712.6	153622.12	153116.17	152844.69	153194.33
629.89	189214.23	188864.85	188458.81	188845.96	714.23	138787.4	138453.45	138230.82	138490.56
631.47	188517.94	188184.41	187774.65	188159	715.86	128791.26	128455.51	128268.99	128505.25
633.07	189002.37	188634.79	188257.54	188631.57	717.49	129790.54	129467.09	129255.61	129504.41
634.66	189124.49	188731.98	188349.27	188735.25	719.11	135235.47	134923.78	134624.56	134927.94
636.26	188484.91	188099.1	187772.64	188118.88	720.74	135504.18	135155.29	134906.09	135188.52
637.86	187731.06	187402.14	186953.62	187362.27	722.36	131915.98	131566.34	131266.64	131582.99
639.46	186387.56	186075.67	185683.3	186048.84	723.99	130739.55	130390.01	130102.89	130410.82
641.06	184401.29	184106.35	183780.89	184096.18	725.61	131251.77	130913.65	130675.72	130947.05
642.66	182535	182289.35	181951.59	182258.65	727.23	133182.05	132792.81	132529.13	132834.66
644.27	181883.79	181543.28	181254.36	181560.48	728.85	137995.56	137667.57	137377.42	137680.18
645.88	181517.82	181194.94	180934.56	181215.77	730.47	145201.98	144822.04	144568.74	144864.25
647.49	180714.06	180482.98	180125.86	180440.97	732.08	151210.9	150841.56	150676	150909.49
649.1	178123.66	177870.06	177479.09	177824.27	733.7	154223.08	153851.27	153671.78	153915.38
650.71	176344.01	175947.58	175647.59	175979.73	735.32	155671.56	155271.67	155078.18	155340.47
652.32	178341.03	177982.63	177711.11	178011.59	736.93	157112.36	156787.53	156605.63	156835.17
653.94	182666.42	182246.67	181981.57	182298.22	738.54	158792.11	158464.3	158254.5	158503.64
655.56	185617.48	185270.66	184879.09	185255.74	740.15	160658.62	160328.07	160090.08	160358.92
657.18	186892.92	186688.77	186269.12	186616.94	741.76	162374.35	162001.07	161867.76	162081.06
658.8	187237.74	186871.89	186494.6	186868.08	743.37	163610.31	163260.11	163004.19	163291.54
660.42	187343.57	187021.28	186652.94	187005.93	744.97	164030.11	163622.04	163390.8	163680.98
662.04	186920.2	186643.94	186252.58	186605.57	746.58	163799.73	163346.25	163153.87	163433.28
663.66	186386.38	185987.14	185644.94	186006.15	748.18	163088.89	162630.19	162435.59	162718.22
665.29	185942.35	185591.22	185194.78	185576.12	749.78	162340.94	161961.9	161765.36	162022.73
666.92	185777.32	185483.82	185122.58	185461.24	751.38	162072.88	161619.33	161420.91	161704.37
668.54	185987.91	185602.87	185274.45	185621.74	752.98	161757.89	161255.4	161054.41	161355.9
670.17	186149.44	185762.27	185466.2	185792.64	754.57	159826.44	159391.42	159217.41	159478.42
671.8	186105.92	185706.36	185420.95	185744.41	756.16	150672.79	150204.23	150043.16	150306.73
673.43	185900.16	185510.6	185155.41	185522.06	757.76	127586.37	127230.69	127141.77	127319.61
675.06	185549.84	185114.09	184793.01	185152.31	759.35	100681.02	100425.79	100335.71	100480.84
676.69	184669.69	184232.66	183933.64	184278.66	760.93	88855.37	88673.85	88477.2	88668.807
678.32	182535.57	182190.25	181787.38	182171.07	762.52	94663.56	94541.42	94342.93	94515.97
679.95	177860.73	177560.84	177226.34	177549.3	764.1	108431.82	108201.44	108124.65	108252.64
681.58	169742.57	169314.71	169014.06	169357.11	765.69	126007.3	125760.65	125637.32	125801.76
683.22	162184.07	161894.29	161616.1	161898.15	767.27	140847.57	140568.54	140305.01	140573.71
684.85	160982.05	160715.08	160320.43	160672.52	768.85	149709.54	149304.75	149055.65	149356.65
686.48	163294.95	162933.65	162665.59	162964.73	770.42	153785.78	153426.65	153348.58	153520.34
688.12	164108.71	163734.7	163395.76	163746.39	772	155367.89	155069.89	154866	155101.26
689.75	163908.86	163452.15	163159.4	163506.8	773.57	156076.32	155714.08	155430.59	155740.33
691.38	165178.91	164826.37	164520.83	164842.04	775.14	156241.92	155815.93	155658.16	155905.34
693.02	167451.93	167027.58	166721.11	167066.87	776.7	156189.07	155777.09	155555.25	155840.47
694.65	167173.92	166808.11	166477.7	166819.91	778.27	155961.57	155548.64	155326.29	155612.17
696.29	165039.46	164684.21	164388.16	164703.94	779.83	155727.48	155313.23	155074.24	155371.65
697.92	164283.38	163963.39	163690.81	163979.19	781.4	155342.11	155007.01	154799.57	155049.56
699.55	165686.03	165424.62	165032.51	165381.05	782.96	154793.18	154456.67	154264.38	154504.74
701.19	167709.12	167340.55	167078.99	167376.22	784.51	153679.71	153422.66	153181.69	153428.02
702.82	169105.25	168722.63	168363.93	168730.6	786.07	152043.05	151656.34	151446.87	151715.42

787.62	149460.96	149121.24	148894.76	149158.99	865.69	123987.92	123620.32	123515.29	123707.84
789.17	147040.76	146894.42	146618	146851.06	867.15	125138.16	124981.11	124850.24	124989.84
790.72	145611.47	145317.21	145170.07	145366.25	868.62	127228.88	126890.57	126786.48	126968.64
792.27	145054.68	144791.43	144626.89	144824.33	870.08	127824.82	127539.44	127487.56	127617.27
793.81	144845.24	144547.1	144298.65	144563.66	871.54	127588.66	127304.73	127175.67	127356.35
795.35	144492.53	144091.81	144041.72	144208.69	873	127058.32	126645.13	126619.3	126774.25
796.89	144247.32	143877.63	143793.61	143972.85	874.46	126616.43	126358.56	126255.41	126410.13
798.43	144139.39	143765.31	143612.28	143838.99	875.91	126409.14	126021.3	125969.59	126133.34
799.97	142984.17	142761.37	142504.3	142749.95	877.37	125792.94	125482.15	125352.65	125542.58
801.5	141883.55	141554.64	141294.97	141577.72	878.83	124700.46	124518.37	124284.27	124501.03
803.03	141343.52	141133.58	140941.13	141139.41	880.29	124275.69	123935.21	123882.83	124031.24
804.56	141952.23	141722.28	141456.95	141710.49	881.74	124267.85	124030.4	123872.1	124056.78
806.09	142545.08	142259.24	142027	142277.11	883.2	123611.18	123371.57	123211.83	123398.19
807.61	141798.73	141436.44	141128.5	141454.56	884.66	122588.29	122157.68	122023.11	122256.36
809.14	138965.93	138618.47	138417.3	138667.23	886.11	121948.27	121703.39	121485.73	121712.46
810.66	134241.67	133889.62	133667.28	133932.86	887.57	121791.13	121377.62	121350.05	121506.27
812.17	126805.53	126413.17	126226.34	126481.68	889.03	120218.51	119855.15	119855.15	119976.27
813.69	117157.54	116835.94	116741.35	116911.61	890.48	116255.45	115971.49	115829.51	116018.82
815.21	108969.4	108548.44	108452.77	108656.87	891.94	109671.16	109382.55	109295.97	109449.89
816.72	105130.17	104898.27	104685.69	104904.71	893.39	100817.48	100640.72	100434.48	100630.89
818.23	106547.1	106078.16	105960.92	106195.39	894.85	91885.55	91615.83	91406.04	91635.807
819.74	110311.05	110153.07	109876.6	110113.57	896.31	85078.86	84895.31	84834.12	84936.097
821.25	110832.57	110632.88	110473.12	110646.19	897.76	81184.32	80902.86	80715.23	80934.137
822.75	109326.76	109024.26	108923.42	109091.48	899.22	81304.06	81336.03	81016.31	81218.8
824.25	112530.59	112143.04	111979.86	112217.83	900.68	86473.36	86244.86	86310.14	86342.787
825.75	116793.38	116545.98	116277.96	116539.11	902.14	92581.69	92414.81	92281.31	92425.937
827.25	116359.01	116234.1	116025.9	116206.34	903.59	92297.24	92126.26	92092.06	92171.853
828.75	115171.54	114812.82	114665.11	114883.16	905.05	86009.51	85939.61	85729.92	85893.013
830.25	115686.14	115344.95	115217	115416.03	906.51	80704.11	80453.14	80453.14	80536.797
831.74	116962.9	116661.28	116532.02	116718.73	907.97	79209.62	78989.09	78878.82	79025.843
833.23	119218.03	118956.25	118825.36	118999.88	909.43	78644.28	78644.28	78493.91	78594.157
834.72	122521.92	122234.98	121948.05	122234.98	910.89	76687.89	76533.9	76379.91	76533.9
836.21	125715.66	125336.73	125158.41	125403.6	912.35	74712.8	74594.33	74594.33	74633.82
837.7	128215.63	127922.23	127741.68	127959.85	913.82	74475.08	74434.64	74313.35	74407.69
839.18	130026.04	129774.98	129501.1	129767.37	915.28	76618.44	76535.52	76494.06	76549.34
840.67	131393.28	131024.26	131001.2	131139.58	916.74	81752	81624.46	81326.87	81567.777
842.15	132149.16	131892.28	131565.36	131868.93	918.21	86419.07	86201.5	86027.44	86216.003
843.63	132653.62	132440.96	132204.67	132433.08	919.68	86731.77	86642.54	86553.31	86642.54
845.11	133453.86	133000.83	132976.99	133143.89	921.14	85100.79	84917.87	84597.77	84872.143
846.59	133230.99	133013.68	132772.23	133005.63	922.61	83207.85	82927.05	82927.05	83020.65
848.07	131577.09	131087.87	131063.4	131242.79	924.08	79457.64	79409.74	79266.06	79377.813
849.54	129542.65	129270.14	129096.72	129303.17	925.55	70343.74	69999.64	69999.64	70114.34
851.02	127854.57	127478.23	127402.97	127578.59	927.02	57699.89	57447.92	57296.74	57481.517
852.49	125139.52	124884.81	124681.04	124901.79	928.49	45531.84	45635.32	45738.8	45635.32
853.96	123520.91	123263.79	123186.65	123323.78	929.97	35247.16	35300.41	35087.43	35211.667
855.43	126324.72	126012.62	125934.59	126090.64	931.44	28992.85	28828.43	28554.4	28791.893
856.9	129688.94	129505.28	129085.49	129426.57	932.92	27083.2	26689.87	26914.63	26895.9
858.37	130738.5	130421.88	130316.34	130492.24	934.4	27474.01	27703.91	27416.53	27531.483
859.83	130930.26	130692.25	130374.91	130665.81	935.88	32106.35	32106.35	32281.8	32164.833
861.3	130985.64	130667.85	130614.88	130756.12	937.36	37957	37897.6	37481.79	37778.797
862.76	129754.4	129463.64	129305.05	129507.7	938.84	38200.61	38200.61	37898.87	38100.03
864.23	126191.47	126006.7	125953.92	126050.7	940.32	35896.88	35958.67	35835.1	35896.883

941.81	34169.81	34169.81	34043.72	34127.78	1020.8	100640.66	101291.35	100423.76	100785.26
943.29	33850.41	33721.71	33399.93	33657.35	1022.33	100592.31	100139.2	100818.87	100516.79
944.78	34449.98	34580.97	34384.49	34471.813	1023.86	100866.59	101337.93	101102.26	101102.26
946.27	35543.59	35610.28	35676.97	35610.28	1025.39	101131.61	100884.95	100391.62	100802.73
947.76	36457.18	36389.41	36050.59	36299.06	1026.91	100609.47	100866.13	99839.5	100438.37
949.25	36501.76	36846.77	36501.76	36616.763	1028.44	101258.75	100455.1	100990.87	100901.57
950.74	37095.75	36815.25	36885.38	36932.127	1029.96	101205.89	101766.58	101766.58	101579.68
952.24	38013.29	37799.73	38155.66	37989.56	1031.48	100756.12	102220.6	101634.81	101537.18
953.74	39696.53	39841.14	39551.91	39696.527	1033	101638.66	101332.52	101332.52	101434.57
955.23	41612.08	41612.08	41391.52	41538.56	1034.51	100583.79	101541.73	101222.42	101115.98
956.73	42446.6	42670	42446.6	42521.067	1036.02	100861.99	102865.87	102197.91	101975.26
958.24	44455.17	44681.98	44379.56	44505.57	1037.53	102451.32	102102.84	100012	101522.05
959.74	48185.62	47955.44	47878.71	48006.59	1039.03	101372.97	102831.57	102466.92	102223.82
961.24	51359.34	51048.07	50892.44	51099.95	1040.54	102105.13	104399.63	104782.04	103762.27
962.75	53281.35	53833.9	53439.22	53518.157	1042.03	101945.33	103538.23	102741.78	102741.78
964.26	58801.11	58961.55	58881.33	58881.33	1043.53	103361.87	104195.43	102945.08	103500.79
965.77	67477.98	67315.58	67396.78	67396.78	1045.02	102619.03	104365.74	102619.03	103201.27
967.28	73957.83	73957.83	73710.21	73875.29	1046.5	103351.08	106538.12	105172.25	105020.48
968.79	76509.42	76509.42	76258.29	76425.71	1047.98	104498.04	104498.04	105923.01	104973.03
970.3	75733.8	75733.8	75478.52	75648.707	1049.46	105257.67	105257.67	104264.67	104926.67
971.82	72531.3	72617.95	72617.95	72589.067	1050.93	104619.02	105136.93	105136.93	104964.29
973.34	72017.13	71840.62	71928.88	71928.877	1052.39	107407.66	106328.19	105788.45	106508.1
974.85	73183.02	73003.65	73272.71	73153.127	1053.85	107141.96	107141.96	107141.96	107141.96
976.37	75516.97	75608.18	75516.97	75547.373	1055.3	106277.48	107458.34	106867.91	106867.91
977.9	77822.24	77729.26	77822.24	77791.247	1056.75	106669.98	107896.07	107283.03	107283.03
979.42	81146.87	81620.86	81336.47	81368.067	1058.19	107368.96	109297.74	108654.81	108440.5
980.94	85049.39	84277.09	84470.16	84598.88	1059.62	109756.34	107760.77	107095.58	108204.23
982.47	88299.26	87905.51	87708.63	87971.133	1061.05	106988.09	106288.82	106988.09	106755
983.99	90924.22	91024.69	91024.69	90991.2	1062.46	106777	110433.74	111165.09	109458.61
985.52	93274.53	93171.92	93069.31	93171.92	1063.87	111464.65	113755.02	107647.37	110955.68
987.05	94913.63	95228.6	94913.63	95018.62	1065.27	112121.85	112121.85	109736.28	111326.66
988.58	96200.92	96415.89	95878.46	96165.09	1066.67	112515.22	109253.91	113330.55	111699.89
990.11	97548.82	97988.72	96998.94	97512.16	1068.05	115187.3	110179.15	108509.77	111292.07
991.64	97696.9	97244.6	97923.05	97621.517	1069.42	112863.7	109443.59	112863.7	111723.66
993.17	98946.58	98830.72	98946.58	98907.96	1070.79	110882.86	114347.95	113481.68	112904.16
994.71	99613.57	99732.59	99137.52	99494.56	1072.14	110090.73	110964.46	112711.93	111255.71
996.24	99430.49	99430.49	99675.1	99512.027	1073.48	113693.43	112812.09	111049.4	112518.31
997.77	99624.95	99624.95	100255.49	99835.13	1074.82	113882.08	113882.08	115647.7	114470.62
999.31	99326.68	99456.18	99456.18	99413.013	1076.14	114343.13	111683.98	111683.98	112570.36
1000.85	99173.33	99173.33	98905.29	99083.983	1077.44	114809.75	113029.76	112139.76	113326.42
1002.38	98311.45	98588.39	98311.45	98403.763	1078.74	112785.54	109176.4	112785.54	111582.49
1003.92	98136.48	97136.54	97850.78	97707.933	1080.02	111253.95	114931.77	112173.41	112786.38
1005.45	98438.88	98734.93	98290.85	98488.22	1081.3	111958.8	113824.78	111958.8	112580.79
1006.99	98680.6	98374.14	98833.83	98629.523	1082.55	109175.68	108226.32	104428.91	107276.97
1008.53	98182.9	99134.6	98500.14	98605.88	1083.79	109241.81	117115.09	111210.13	112522.34
1010.06	100208.08	99878.44	99548.81	99878.443	1085.02	112573.1	114583.34	109557.75	112238.06
1011.6	99631.74	99802.93	99974.12	99802.93	1086.24	111840.24	115982.47	112875.8	113566.17
1013.13	100202.47	100913.13	99847.14	100320.91	1087.43	115667.25	112454.28	114596.26	114239.26
1014.67	99574.99	100498.69	99574.99	99882.89	1088.62	110566.88	112778.22	113883.89	112409.66
1016.2	100760.53	100568.6	100376.68	100568.6	1089.78	112675.07	120723.29	109225.84	114208.07
1017.74	100656.01	100455.89	100055.67	100389.19					
1019.27	100106.72	100731.09	100314.84	100384.22					

APPENDIX D

HYPERION REMOTE SENSING REFLECTANCE CORRELATIONS FOR SINGLE BAND, BANDS RATIO, BANDS COMBINATION RATIO, LOG BANDS RATIO, LOG BANDS COMBINATION RATIO, AND LOG BANDS RATIO

APPENDIX D-1

SINGLE BAND REGRESSIONS

MAY 12, 2006

Hyperion Reflectances 5-12-2006

	266	268	269	270	271	272	276	277	280	281	282	283	284	286	287	288	292	294	295	296	298	299	300	301	302	304	305	r
396.3	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	0.0000
406.5	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.0000
416.6	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.0000
426.8	0.062	0.07	0.057	0.067	0.065	0.069	0.059	0.051	0.035	0.03	0.091	0.1	0.107	0.112	0.093	0.061	0.051	0.106	0.109	0.096	0.038	0.038	0.039	0.037	0.038	0.034	0.049	0.0000
437	0.094	0.113	0.089	0.106	0.11	0.112	0.082	0.083	0.063	0.06	0.146	0.169	0.181	0.19	0.154	0.092	0.08	0.17	0.177	0.156	0.056	0.059	0.054	0.061	0.061	0.056	0.08	0.0000
447.2	0.14	0.177	0.133	0.161	0.157	0.164	0.12	0.122	0.088	0.082	0.217	0.245	0.268	0.285	0.23	0.137	0.116	0.258	0.261	0.229	0.078	0.088	0.087	0.084	0.076	0.078	0.125	0.0000
457.3	0.184	0.239	0.177	0.208	0.215	0.216	0.163	0.165	0.117	0.112	0.295	0.32	0.356	0.372	0.308	0.182	0.155	0.34	0.342	0.308	0.102	0.12	0.115	0.115	0.111	0.108	0.162	0.0000
467.5	0.235	0.297	0.23	0.262	0.266	0.269	0.21	0.205	0.145	0.137	0.353	0.379	0.442	0.46	0.378	0.224	0.199	0.417	0.417	0.374	0.133	0.148	0.148	0.145	0.138	0.137	0.203	0.0000
477.7	0.24	0.3	0.228	0.264	0.272	0.262	0.208	0.212	0.152	0.139	0.347	0.379	0.432	0.447	0.367	0.225	0.201	0.397	0.414	0.367	0.133	0.157	0.157	0.156	0.143	0.141	0.205	0.0000
487.9	0.246	0.307	0.237	0.272	0.277	0.269	0.206	0.221	0.151	0.142	0.351	0.386	0.436	0.452	0.37	0.229	0.202	0.409	0.415	0.372	0.13	0.159	0.163	0.164	0.15	0.147	0.209	0.0000
498	0.256	0.309	0.242	0.281	0.286	0.275	0.218	0.224	0.157	0.145	0.355	0.391	0.446	0.45	0.376	0.237	0.214	0.41	0.422	0.379	0.136	0.172	0.17	0.168	0.16	0.155	0.214	0.0000
508.2	0.264	0.323	0.251	0.286	0.298	0.283	0.224	0.231	0.163	0.147	0.36	0.393	0.455	0.46	0.385	0.236	0.219	0.421	0.425	0.387	0.141	0.177	0.182	0.177	0.167	0.164	0.225	0.0000
518.4	0.265	0.331	0.257	0.295	0.304	0.291	0.229	0.24	0.17	0.151	0.369	0.399	0.46	0.461	0.393	0.246	0.227	0.425	0.433	0.395	0.145	0.183	0.19	0.188	0.176	0.17	0.233	0.0000
528.6	0.268	0.335	0.263	0.294	0.31	0.291	0.231	0.238	0.172	0.155	0.366	0.402	0.463	0.468	0.391	0.244	0.228	0.424	0.431	0.395	0.144	0.192	0.193	0.189	0.179	0.177	0.236	0.0000
538.7	0.273	0.336	0.264	0.299	0.313	0.295	0.231	0.241	0.173	0.154	0.365	0.403	0.464	0.469	0.393	0.249	0.232	0.426	0.431	0.395	0.146	0.197	0.199	0.192	0.184	0.178	0.238	0.0000
548.9	0.276	0.344	0.265	0.304	0.318	0.297	0.234	0.246	0.174	0.155	0.373	0.403	0.469	0.468	0.398	0.25	0.237	0.427	0.435	0.401	0.145	0.203	0.205	0.198	0.188	0.183	0.242	0.0000
559.1	0.279	0.344	0.27	0.307	0.32	0.299	0.237	0.245	0.177	0.156	0.366	0.402	0.465	0.465	0.394	0.25	0.238	0.424	0.43	0.397	0.146	0.205	0.208	0.203	0.191	0.189	0.244	0.0000
569.3	0.283	0.35	0.271	0.308	0.321	0.301	0.239	0.248	0.179	0.157	0.369	0.4	0.472	0.467	0.395	0.251	0.241	0.421	0.43	0.396	0.145	0.21	0.214	0.208	0.196	0.191	0.247	0.0000
579.5	0.284	0.352	0.274	0.31	0.327	0.305	0.237	0.254	0.18	0.156	0.37	0.404	0.472	0.468	0.4	0.252	0.243	0.426	0.432	0.4	0.147	0.212	0.22	0.211	0.199	0.193	0.248	0.0000
589.6	0.286	0.352	0.275	0.314	0.324	0.302	0.239	0.25	0.177	0.155	0.369	0.404	0.472	0.466	0.398	0.25	0.241	0.424	0.429	0.4	0.143	0.214	0.221	0.217	0.199	0.197	0.249	0.0000
599.8	0.285	0.355	0.276	0.311	0.327	0.309	0.242	0.255	0.182	0.155	0.377	0.407	0.48	0.47	0.403	0.256	0.246	0.432	0.436	0.408	0.151	0.219	0.227	0.219	0.206	0.199	0.251	0.0000
610	0.289	0.358	0.279	0.315	0.328	0.306	0.238	0.258	0.176	0.156	0.373	0.404	0.474	0.467	0.399	0.256	0.245	0.427	0.431	0.404	0.147	0.225	0.232	0.223	0.211	0.206	0.255	0.0000
620.2	0.287	0.353	0.275	0.312	0.327	0.305	0.236	0.254	0.18	0.154	0.368	0.4	0.471	0.464	0.397	0.251	0.243	0.422	0.426	0.397	0.146	0.224	0.229	0.221	0.209	0.204	0.257	0.0000
630.3	0.289	0.354	0.278	0.315	0.327	0.304	0.236	0.255	0.178	0.156	0.369	0.401	0.474	0.465	0.396	0.254	0.244	0.425	0.428	0.401	0.146	0.225	0.231	0.225	0.209	0.203	0.256	0.0000
640.5	0.29	0.356	0.275	0.315	0.329	0.303	0.236	0.259	0.18	0.155	0.369	0.402	0.475	0.466	0.398	0.253	0.244	0.428	0.427	0.404	0.143	0.226	0.233	0.226	0.213	0.209	0.254	0.0000
650.7	0.296	0.368	0.285	0.324	0.335	0.308	0.243	0.261	0.182	0.157	0.379	0.408	0.484	0.471	0.404	0.256	0.249	0.431	0.435	0.409	0.147	0.233	0.237	0.231	0.217	0.208	0.261	0.0000
660.8	0.296	0.365	0.282	0.325	0.333	0.312	0.241	0.263	0.182	0.156	0.378	0.412	0.49	0.474	0.408	0.259	0.25	0.436	0.439	0.414	0.148	0.23	0.239	0.233	0.221	0.211	0.266	0.0000
671	0.294	0.364	0.283	0.322	0.332	0.305	0.238	0.264	0.182	0.154	0.376	0.407	0.481	0.472	0.404	0.258	0.246	0.429	0.429	0.407	0.146	0.234	0.242	0.233	0.215	0.212	0.263	0.0000
681.2	0.299	0.368	0.286	0.324	0.334	0.307	0.239	0.264	0.179	0.156	0.376	0.406	0.485	0.472	0.405	0.257	0.246	0.43	0.432	0.41	0.145	0.237	0.242	0.232	0.221	0.214	0.266	0.0000
691.4	0.3	0.374	0.287	0.327	0.33	0.306	0.246	0.264	0.183	0.158	0.377	0.407	0.484	0.472	0.407	0.259	0.25	0.43	0.435	0.41	0.149	0.237	0.243	0.233	0.222	0.213	0.264	0.0000
701.5	0.297	0.371	0.287	0.324	0.33	0.317	0.251	0.266	0.184	0.163	0.391	0.423	0.504	0.488	0.419	0.27	0.256	0.444	0.451	0.424	0.152	0.239	0.247	0.24	0.223	0.218	0.262	0.0000
711.7	0.289	0.36	0.278	0.315	0.321	0.312	0.251	0.255	0.179	0.162	0.385	0.413	0.499	0.49	0.419	0.267	0.248	0.442	0.443	0.422	0.153	0.23	0.239	0.229	0.216	0.209	0.25	0.0000
721.9	0.282	0.355	0.27	0.311	0.316	0.316	0.265	0.25	0.181	0.173	0.411	0.445	0.531	0.52	0.447	0.284	0.251	0.469	0.471	0.449	0.162	0.23	0.235	0.228	0.217	0.209	0.252	0.0000
732.1	0.279	0.348	0.269	0.309	0.318	0.322	0.27	0.253	0.188	0.177	0.405	0.442	0.528	0.524	0.45	0.29	0.254	0.473	0.469	0.45	0.17	0.234	0.242	0.234	0.221	0.219	0.255	0.0000
742.3	0.278	0.346	0.265	0.302	0.307	0.308	0.261	0.248	0.185	0.176	0.381	0.415	0.495	0.488	0.433	0.282	0.251	0.445	0.441	0.421	0.168	0.234	0.238	0.229	0.216	0.211	0.249	0.0000
752.4	0.276	0.346	0.264	0.301	0.302	0.304	0.262	0.244	0.179	0.176	0.374	0.406	0.487	0.477	0.421	0.28	0.245	0.437	0.428	0.414	0.165	0.229	0.232	0.229	0.213	0.208	0.247	0.0000
762.6	0.274	0.339	0.258	0.295	0.3	0.307	0.265	0.244	0.182	0.18	0.385	0.413	0.493	0.489	0.427	0.284	0.245	0.447	0.442	0.424	0.171	0.229	0.234	0.228	0.213	0.207	0.244	0.0000
772.8	0.283	0.348	0.268	0.309	0.312	0.315	0.273	0.252	0.191	0.185	0.389	0.42	0.504	0.497	0.437	0.291	0.254	0.457	0.45	0.436	0.178	0.242	0.246	0.237	0.224	0.218	0.255	0.0000
783	0.279	0.343	0.264	0.3	0.302	0.306	0.265	0.248	0.186	0.181	0.383	0.412	0.492	0.489	0.43	0.285	0.249	0.442	0.435	0.423	0.176	0.229	0.236	0.232	0.216	0.211	0.247	0.0000
793.1	0.273	0.34	0.261	0.299	0.305	0.314	0.269	0.245	0.183	0.181	0.385	0.419	0.498	0.489	0.432	0.285	0.25	0.446	0.44	0.424	0.174	0.23	0.236	0.23	0.218	0.214	0.246	0.0000
803.3	0.277	0.343	0.264	0.3	0.307	0.313	0.271	0.248	0.184	0.182	0.387	0.42	0.504	0.498	0.438	0.291	0.253	0.451	0.449	0.434	0.175	0.23	0.238	0.232	0.221	0.216	0.252	0.0000
813.5	0.275	0.342	0.26	0.298	0.302	0.313	0.275	0.242	0.182	0.184	0.405	0.43	0.518	0.508	0.439	0.293	0.25	0.453	0.455	0.442	0.172	0.23	0.237	0.232	0.215	0.212	0.241	0.0000
823.7	0.279	0.346	0.266	0.302	0.311	0.326	0.287	0.253	0.19	0.19	0.416	0.448	0.546	0.532	0.466	0.313	0.264	0.482	0.482	0.461	0.184	0.238	0.246	0.237	0.232	0.223	0.25	0.0000
833.8	0.278	0.348	0.264	0.306	0.311	0.324	0.281	0.252	0.191	0.184	0.408	0.445	0.53	0.523	0.457	0.309	0.261	0.472	0.472	0.453	0.185	0.244	0.244	0.237	0.232	0.231	0.256	0.0000
844	0.28	0.351	0.268	0.306	0.309	0.317	0.271	0.251	0.192	0.191	0.397	0.427	0.51	0.499	0.445	0.297	0.258	0.451	0.452	0.437	0.176	0.239	0.249	0.241	0.23	0.222	0.251	0.0000
854.2	0.28	0.348	0.266	0.312	0.309	0.316	0.281	0.247	0.192	0.188	0.386	0.425	0.509	0.499	0.446	0.298	0.258	0.451	0.454	0.431	0.18	0.242	0.247	0.24	0.229	0.227	0.252	0.0000
864.3	0.278	0.348	0.265	0.31	0.306	0.315	0.269	0.248	0.188	0.192	0.391	0.42	0.5	0.49	0.442	0.299	0.256	0.45	0.443	0.434	0.185	0.242	0.25	0.242	0.232	0.23	0.251	0.0000
874.5	0.283	0.348	0.265	0.304	0.305	0.315	0.277	0.252	0.187	0.189	0.394	0.42	0.508	0.497	0.448	0.302	0.253	0.446	0.443	0.432	0.186	0.241	0.246	0.242	0.23	0.225	0.254	0.0000
884.7	0.282	0.351	0.269	0.309	0.308	0.321	0.282	0.255	0.194	0.193	0.398	0.436	0.52	0.509	0.456	0.308	0.262	0.466	0.45	0.446	0.187	0.245	0.256	0.242	0.235	0.226	0.251	0.0000
894.9	0.246	0.299	0.231	0.262	0.26	0.273	0.253	0.219	0.158	0.165	0.355	0.382	0.468	0.452	0.391	0.261	0.224	0.403	0.407	0.393	0.16	0.207	0.219	0.207	0.2	0.195	0.213	0.0000
905	0.212	0.251	0.196	0.22	0.218	0.234	0.227	0.185	0.146	0.146	0.323	0.356	0.427	0.415	0.366	0.234	0.199	0.363	0.373	0.361	0.146	0.181	0.192	0.189	0.178	0.178	0.189	0.0000
915.2	0.165	0.216	0.164	0.193	0.183	0.209	0.183	0.146	0.104	0.131	0.279	0.294	0.348	0.352	0.309	0.215	0.165	0.323	0.311	0.315	0.133	0.145	0.149	0.149	0.153	0.149	0.152	0.0000

925.4	0.145	0.181	0.14	0.157	0.158	0.165	0.162	0.131	0.107	0.112	0.227	0.241	0.27	0.274	0.251	0.164	0.131	0.262	0.247	0.257	0.114	0.118	0.132	0.118	0.123	0.132	0.12	0.0000
935.6	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	0.0000
945.8	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	0.0000
955.9	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.0000
966.1	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.0000
976.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
986.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
996.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
1007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
1017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
1027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
1037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
1048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
1058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
851.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
862	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
872.1	-0.03	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	0.0000
882.2	-0.06	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	0.0000
892.3	-0.09	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	0.0000
902.4	-0.13	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	0.0000
912.5	0.141	0.199	0.162	0.171	0.168	0.207	0.122	0.102	0.117	0.084	0.203	0.218	0.24	0.323	0.263	0.175	0.141	0.245	0.253	0.242	0.095	0.082	0.118	0.109	0.112	0.144	0.12	0.0000
922.5	0.174	0.244	0.19	0.202	0.205	0.268	0.156	0.121	0.119	0.097	0.247	0.271	0.301	0.362	0.317	0.211	0.166	0.316	0.348	0.29	0.121	0.127	0.122	0.148	0.138	0.157	0.149	0.0000
932.6	0.182	0.192	0.191	0.151	0.237	0.383	0.158	0.246	0.074	0.116	0.282	0.402	0.374	0.581	0.397	0.261	0.21	0.371	0.49	0.377	0.284	0.198	0.105	0.101	0.131	0.103	0.184	0.0000
942.7	0.217	0.271	0.243	0.215	0.272	0.468	0.196	0.256	0.111	0.133	0.372	0.489	0.472	0.78	0.499	0.334	0.232	0.488	0.654	0.431	0.334	0.232	0.163	0.125	0.129	0.164	0.199	0.0000
952.8	0.283	0.38	0.307	0.359	0.256	0.586	0.29	0.241	0.268	0.134	0.515	0.596	0.573	0.845	0.607	0.397	0.307	0.557	0.644	0.552	0.185	0.201	0.244	0.228	0.255	0.182	0.272	0.0000
962.9	0.297	0.391	0.268	0.337	0.29	0.457	0.258	0.272	0.238	0.172	0.444	0.538	0.518	0.663	0.551	0.367	0.309	0.498	0.538	0.495	0.18	0.232	0.26	0.244	0.237	0.214	0.268	0.0000
973	0.289	0.387	0.267	0.303	0.309	0.403	0.253	0.244	0.207	0.181	0.414	0.499	0.533	0.603	0.511	0.337	0.287	0.498	0.518	0.466	0.177	0.237	0.257	0.258	0.256	0.232	0.246	0.0000
983.1	0.296	0.38	0.272	0.318	0.319	0.403	0.247	0.267	0.212	0.181	0.406	0.479	0.513	0.566	0.501	0.345	0.293	0.479	0.51	0.464	0.182	0.252	0.264	0.265	0.267	0.24	0.259	0.0000
993.2	0.29	0.365	0.261	0.315	0.316	0.396	0.244	0.256	0.206	0.18	0.387	0.456	0.483	0.524	0.48	0.335	0.274	0.455	0.494	0.444	0.191	0.238	0.265	0.248	0.251	0.243	0.266	0.0000
1003	2860	0.359	0.259	0.311	0.318	0.389	0.242	0.253	0.195	0.171	0.375	0.432	0.465	0.519	0.466	0.326	0.267	0.46	0.497	0.44	0.19	0.244	0.266	0.252	0.256	0.243	0.267	0.0000
1013	2868	0.35	0.26	0.318	0.312	0.374	0.226	0.254	0.21	0.185	0.373	0.445	0.476	0.517	0.48	0.323	0.275	0.447	0.468	0.433	0.179	0.243	0.261	0.243	0.244	0.239	0.259	0.0000
1023	2895	0.348	0.262	0.316	0.304	0.376	0.235	0.255	0.205	0.18	0.362	0.437	0.471	0.517	0.468	0.324	0.267	0.446	0.468	0.434	0.183	0.246	0.258	0.24	0.238	0.231	0.26	0.0000
1034	2829	0.35	0.257	0.296	0.301	0.379	0.247	0.246	0.209	0.18	0.377	0.43	0.468	0.504	0.479	0.32	0.274	0.438	0.463	0.419	0.18	0.235	0.258	0.244	0.249	0.235	0.259	0.0000
1044	2746	0.346	0.257	0.298	0.302	0.372	0.242	0.246	0.206	0.18	0.373	0.435	0.467	0.498	0.468	0.321	0.268	0.429	0.455	0.411	0.182	0.231	0.25	0.237	0.241	0.237	0.255	0.0000
1054	2696	0.343	0.244	0.299	0.299	0.366	0.224	0.237	0.194	0.172	0.365	0.426	0.461	0.501	0.449	0.316	0.263	0.438	0.448	0.43	0.17	0.238	0.251	0.229	0.233	0.224	0.25	0.0000
1064	2612	0.334	0.235	0.293	0.285	0.358	0.222	0.222	0.192	0.166	0.357	0.424	0.453	0.488	0.438	0.315	0.256	0.421	0.436	0.414	0.165	0.231	0.241	0.225	0.225	0.216	0.242	0.0000
1074	2583	0.314	0.227	0.275	0.272	0.346	0.213	0.22	0.181	0.158	0.339	0.398	0.427	0.472	0.425	0.297	0.239	0.415	0.428	0.395	0.162	0.213	0.236	0.223	0.226	0.206	0.233	0.0000
1084	2476	0.303	0.218	0.272	0.262	0.339	0.206	0.213	0.175	0.156	0.338	0.394	0.422	0.465	0.422	0.3	0.23	0.405	0.423	0.387	0.156	0.205	0.224	0.214	0.219	0.2	0.222	0.0000
1094	2460	0.3	0.221	0.267	0.268	0.327	0.205	0.212	0.178	0.155	0.349	0.414	0.445	0.483	0.43	0.299	0.234	0.419	0.443	0.409	0.155	0.209	0.224	0.209	0.212	0.198	0.21	0.0000
1104	2374	0.29	0.222	0.25	0.257	0.352	0.211	0.201	0.177	0.16	0.374	0.447	0.482	0.511	0.452	0.308	0.231	0.444	0.486	0.425	0.153	0.187	0.195	0.194	0.193	0.189	0.201	0.0000
1114	2291	0.24	0.208	0.228	0.231	0.373	0.27	0.173	0.167	0.156	0.45	0.488	0.585	0.622	0.481	0.307	0.236	0.458	0.533	0.466	0.169	0.166	0.158	0.185	0.184	0.156	0.184	0.0000
1124	3160	0.057	0.2	0.189	0.146	0.594	0.361	0.114	0.227	0.122	0.678	0.686	0.851	1.043	0.6	0.357	0.312	0.478	0.867	0.527	0.257	0.117	0.095	0.158	0.233	0.141	0.082	0.0000
1134	1910	0.277	0.203	0.268	0.192	0.549	0.165	0.108	0.193	0.124	0.538	0.779	0.73	0.876	0.787	0.417	0.304	0.646	0.823	0.644	0.119	0.267	0.167	0.122	0.172	0.122	0.111	0.0000
1144	1886	0.287	0.188	0.306	0.202	0.545	0.184	0.096	0.216	0.16	0.557	0.743	0.73	0.867	0.783	0.41	0.301	0.631	0.823	0.636	0.15	0.269	0.144	0.115	0.174	0.089	0.137	0.0000
1155	2477	0.308	0.209	0.27	0.267	0.446	0.236	0.219	0.197	0.167	0.431	0.573	0.58	0.671	0.585	0.373	0.271	0.55	0.633	0.538	0.205	0.231	0.239	0.224	0.232	0.238	0.257	0.0000
1165	2620	0.323	0.223	0.287	0.273	0.386	0.232	0.231	0.192	0.153	0.384	0.479	0.503	0.573	0.486	0.341	0.253	0.472	0.528	0.47	0.181	0.232	0.242	0.234	0.24	0.237	0.249	0.0000
1175	2604	0.321	0.232	0.287	0.286	0.367	0.23	0.238	0.195	0.163	0.374	0.445	0.472	0.533	0.473	0.327	0.252	0.454	0.48	0.448	0.164	0.243	0.252	0.247	0.247	0.24	0.253	0.0000
1185	2577	0.319	0.231	0.284	0.293	0.379	0.23	0.23	0.191	0.163	0.374	0.442	0.475	0.541	0.474	0.331	0.26	0.448	0.49	0.438	0.163	0.24	0.257	0.242	0.244	0.234	0.252	0.0000
1195	2667	0.335	0.249	0.291	0.291	0.358	0.226	0.238	0.195	0.154	0.385	0.451	0.48	0.541	0.469	0.33	0.257	0.44	0.495	0.441	0.168	0.232	0.249	0.246	0.24	0.225	0.251	0.0000
1205	2649	0.325	0.244	0.291	0.287	0.357	0.218	0.239	0.199	0.157	0.371	0.439	0.473	0.521	0.464	0.328	0.26	0.437	0.482	0.429	0.164	0.229	0.254	0.244	0.244	0.231	0.243	0.0000
1215	2657	0.33	0.238	0.284	0.287	0.351	0.213	0.23	0.187	0.157	0.355	0.412	0.444	0.497	0.439	0.31	0.246	0.415	0.454	0.402	0.162	0.225	0.243	0.222	0.229	0.219	0.231	0.0000
1225	2726	0.333	0.24	0.293	0.293	0.353	0.216	0.228	0.187	0.158	0.347	0.411	0.442	0.485	0.437	0.307	0.248	0.419	0.446	0.403	0.162	0.23	0.248	0.23	0.235	0.227	0.24	0.0000
1235	2705	0.329	0.246	0.292	0.294	0.341	0.218	0.234	0.189	0.157	0.345	0.411	0.443	0.498	0.434	0.307	0.244	0.416	0.445	0.415	0.167	0.237	0.253	0.242	0.242	0.232	0.244	0.0000
1245	2640	0.33	0.243	0.288	0.289	0.344	0.215	0.234	0.188	0.158	0.346	0.41	0.45	0.492	0.441	0.315	0.251	0.415	0.443	0.413	0.164	0.237	0.253	0.238	0.241	0.236	0.242	0.0000
1255	2714	0.33	0.249	0.295	0.29	0.354	0.213	0.234	0.186	0.154	0.345	0.409	0.445	0.488	0.438	0.315	0.259	0.417	0.44	0.416	0.16	0.244	0.258	0.241	0.241	0.236	0.245	0.0000

1266	2682	0.331	0.243	0.294	0.282	0.351	0.213	0.236	0.191	0.158	0.349	0.424	0.461	0.492	0.45	0.318	0.268	0.413	0.447	0.407	0.16	0.237	0.254	0.238	0.231	0.231	0.236	0.0000
1276	2621	0.328	0.235	0.285	0.277	0.335	0.214	0.232	0.182	0.154	0.334	0.397	0.428	0.481	0.421	0.307	0.245	0.402	0.436	0.402	0.167	0.227	0.248	0.234	0.242	0.226	0.239	0.0000
1286	2479	0.313	0.225	0.283	0.271	0.33	0.209	0.219	0.183	0.151	0.337	0.398	0.427	0.474	0.421	0.302	0.239	0.4	0.43	0.392	0.165	0.222	0.246	0.23	0.233	0.22	0.235	0.0000
1296	2424	0.306	0.224	0.273	0.275	0.332	0.21	0.23	0.175	0.149	0.338	0.403	0.439	0.477	0.428	0.296	0.237	0.4	0.439	0.395	0.163	0.223	0.237	0.223	0.224	0.215	0.231	0.0000
1306	2475	0.298	0.221	0.275	0.277	0.345	0.217	0.227	0.169	0.147	0.351	0.418	0.445	0.508	0.433	0.306	0.233	0.419	0.474	0.415	0.168	0.222	0.232	0.224	0.229	0.219	0.232	0.0000
1316	2430	0.31	0.223	0.267	0.262	0.354	0.219	0.219	0.184	0.154	0.384	0.441	0.473	0.537	0.454	0.32	0.246	0.457	0.493	0.458	0.161	0.229	0.239	0.229	0.231	0.223	0.23	0.0000
1326	2275	0.305	0.221	0.251	0.257	0.37	0.231	0.202	0.179	0.158	0.42	0.475	0.521	0.607	0.492	0.341	0.253	0.479	0.517	0.473	0.143	0.22	0.236	0.213	0.21	0.208	0.221	0.0000
1336	2561	0.292	0.231	0.265	0.266	0.354	0.281	0.223	0.141	0.16	0.444	0.546	0.554	0.683	0.565	0.363	0.244	0.521	0.613	0.533	0.197	0.21	0.212	0.184	0.206	0.205	0.214	0.0000
1457	1979	0.134	0.103	0.266	0.032	0.571	-0.01	0.09	0.032	-0.05	0.456	0.259	0.323	0.655	0.428	0.266	0.191	0.313	0.577	0.374	0.025	0.097	0.049	0.043	-0.05	0.049	-0.02	0.0000
1467	2148	0.033	0.038	0.205	0.032	0.559	-0.12	0.069	0.053	-0.11	0.481	0.142	0.178	0.668	0.371	0.21	0.189	0.303	0.574	0.397	-0.01	0.079	-0.01	-0.04	-0.1	-0.06	-0.1	0.0000
1477	1006	0.205	0.238	0.208	0.342	0.372	0.141	0.254	0.202	0.084	0.339	0.476	0.407	0.561	0.55	0.471	0.298	0.465	0.725	0.487	0.15	0.202	0.18	0.219	0.216	0.271	0.219	0.0000
1488	2151	0.278	0.233	0.251	0.299	0.309	0.16	0.23	0.19	0.108	0.29	0.368	0.363	0.464	0.412	0.351	0.258	0.372	0.482	0.362	0.138	0.21	0.203	0.216	0.231	0.239	0.233	0.0000
1498	2499	0.299	0.233	0.264	0.261	0.284	0.188	0.219	0.175	0.113	0.256	0.306	0.332	0.402	0.351	0.266	0.24	0.306	0.357	0.327	0.124	0.208	0.232	0.215	0.231	0.219	0.224	0.0000
1508	2661	0.312	0.241	0.276	0.275	0.289	0.178	0.224	0.178	0.118	0.253	0.303	0.327	0.378	0.346	0.266	0.241	0.299	0.35	0.32	0.131	0.227	0.25	0.229	0.237	0.231	0.229	0.0000
1518	2648	0.322	0.247	0.285	0.286	0.3	0.181	0.241	0.181	0.116	0.265	0.315	0.342	0.387	0.361	0.28	0.246	0.318	0.365	0.337	0.132	0.233	0.254	0.241	0.249	0.238	0.246	0.0000
1528	2611	0.333	0.253	0.289	0.297	0.3	0.183	0.241	0.186	0.122	0.272	0.324	0.346	0.388	0.361	0.282	0.247	0.32	0.357	0.34	0.133	0.241	0.256	0.248	0.257	0.242	0.248	0.0000
1538	2688	0.327	0.251	0.289	0.282	0.302	0.184	0.235	0.181	0.126	0.272	0.324	0.347	0.392	0.352	0.278	0.249	0.319	0.357	0.339	0.133	0.233	0.255	0.241	0.256	0.242	0.241	0.0000
1548	2653	0.321	0.249	0.286	0.283	0.3	0.185	0.234	0.18	0.126	0.268	0.324	0.348	0.395	0.352	0.277	0.244	0.321	0.36	0.341	0.138	0.229	0.259	0.243	0.255	0.239	0.243	0.0000
1558	2588	0.33	0.254	0.281	0.284	0.296	0.184	0.235	0.179	0.129	0.278	0.334	0.365	0.392	0.366	0.283	0.255	0.334	0.361	0.341	0.138	0.235	0.266	0.251	0.261	0.242	0.243	0.0000
1568	2618	0.325	0.259	0.278	0.28	0.297	0.188	0.231	0.179	0.13	0.284	0.341	0.369	0.39	0.375	0.288	0.259	0.342	0.366	0.35	0.145	0.236	0.271	0.252	0.263	0.242	0.246	0.0000
1578	2752	0.33	0.256	0.289	0.281	0.304	0.195	0.229	0.182	0.127	0.283	0.344	0.365	0.402	0.371	0.295	0.254	0.336	0.379	0.354	0.135	0.233	0.262	0.249	0.257	0.238	0.234	0.0000
1588	2751	0.32	0.26	0.285	0.286	0.303	0.19	0.228	0.179	0.133	0.288	0.354	0.376	0.406	0.371	0.294	0.254	0.344	0.384	0.359	0.14	0.229	0.26	0.25	0.259	0.239	0.237	0.0000
1599	2600	0.32	0.245	0.282	0.291	0.301	0.191	0.236	0.177	0.134	0.293	0.345	0.381	0.417	0.376	0.287	0.246	0.346	0.38	0.361	0.142	0.24	0.261	0.247	0.257	0.241	0.23	0.0000
1609	2653	0.315	0.248	0.287	0.295	0.307	0.191	0.236	0.178	0.138	0.302	0.349	0.388	0.421	0.381	0.289	0.25	0.351	0.395	0.368	0.148	0.24	0.262	0.251	0.256	0.246	0.232	0.0000
1619	2566	0.339	0.238	0.293	0.289	0.318	0.191	0.234	0.184	0.133	0.289	0.355	0.388	0.416	0.38	0.295	0.247	0.36	0.387	0.374	0.147	0.242	0.264	0.251	0.267	0.251	0.241	0.0000
1629	2533	0.327	0.234	0.292	0.292	0.309	0.197	0.228	0.185	0.136	0.305	0.359	0.396	0.428	0.392	0.294	0.251	0.36	0.382	0.376	0.145	0.237	0.26	0.249	0.261	0.248	0.242	0.0000
1639	2720	0.321	0.238	0.288	0.284	0.316	0.199	0.229	0.176	0.138	0.301	0.364	0.396	0.425	0.404	0.3	0.25	0.366	0.394	0.383	0.148	0.236	0.267	0.258	0.258	0.244	0.242	0.0000
1649	2712	0.32	0.238	0.286	0.288	0.318	0.199	0.224	0.179	0.144	0.305	0.368	0.398	0.429	0.403	0.301	0.253	0.367	0.396	0.379	0.15	0.234	0.266	0.251	0.262	0.243	0.238	0.0000
1659	2609	0.322	0.237	0.281	0.282	0.319	0.196	0.233	0.188	0.137	0.318	0.371	0.413	0.426	0.406	0.294	0.253	0.361	0.41	0.387	0.145	0.246	0.265	0.251	0.265	0.256	0.239	0.0000
1669	2687	0.32	0.242	0.28	0.274	0.315	0.195	0.231	0.189	0.136	0.318	0.373	0.414	0.436	0.408	0.293	0.255	0.356	0.408	0.376	0.149	0.238	0.262	0.248	0.257	0.245	0.233	0.0000
1679	2606	0.323	0.233	0.279	0.283	0.32	0.199	0.227	0.183	0.137	0.315	0.373	0.411	0.439	0.402	0.298	0.254	0.366	0.41	0.39	0.15	0.235	0.266	0.253	0.255	0.249	0.235	0.0000
1689	2607	0.324	0.23	0.28	0.281	0.321	0.194	0.226	0.183	0.137	0.319	0.374	0.407	0.444	0.4	0.303	0.253	0.354	0.408	0.382	0.146	0.225	0.253	0.244	0.251	0.238	0.233	0.0000
1699	2566	0.316	0.234	0.275	0.266	0.322	0.196	0.225	0.175	0.132	0.312	0.366	0.407	0.436	0.4	0.299	0.244	0.383	0.413	0.398	0.149	0.237	0.263	0.253	0.259	0.252	0.238	0.0000
1710	2504	0.31	0.23	0.275	0.269	0.312	0.194	0.22	0.179	0.141	0.319	0.371	0.414	0.445	0.401	0.299	0.241	0.377	0.418	0.395	0.145	0.231	0.261	0.247	0.255	0.245	0.232	0.0000
1720	2422	0.307	0.229	0.271	0.27	0.306	0.192	0.222	0.174	0.133	0.305	0.368	0.409	0.442	0.393	0.295	0.236	0.37	0.404	0.387	0.147	0.232	0.255	0.249	0.256	0.24	0.232	0.0000
1730	2494	0.303	0.224	0.267	0.268	0.31	0.185	0.22	0.172	0.13	0.302	0.367	0.404	0.439	0.39	0.288	0.238	0.366	0.401	0.386	0.142	0.229	0.244	0.24	0.249	0.234	0.229	0.0000
1740	2306	0.294	0.22	0.252	0.256	0.304	0.186	0.216	0.166	0.124	0.308	0.361	0.406	0.428	0.387	0.284	0.237	0.362	0.403	0.373	0.145	0.215	0.242	0.236	0.232	0.226	0.222	0.0000
1750	2301	0.284	0.216	0.253	0.253	0.305	0.187	0.211	0.166	0.123	0.309	0.366	0.406	0.441	0.391	0.284	0.233	0.364	0.402	0.385	0.145	0.213	0.246	0.231	0.241	0.227	0.219	0.0000
1760	2323	0.296	0.219	0.253	0.254	0.313	0.192	0.21	0.155	0.122	0.324	0.375	0.413	0.444	0.411	0.3	0.236	0.388	0.422	0.394	0.142	0.217	0.232	0.227	0.236	0.219	0.218	0.0000
1770	2266	0.301	0.222	0.248	0.253	0.341	0.213	0.212	0.152	0.128	0.345	0.401	0.452	0.505	0.452	0.318	0.243	0.429	0.464	0.44	0.143	0.222	0.236	0.236	0.237	0.219	0.217	0.0000
1780	2177	0.268	0.204	0.266	0.258	0.367	0.222	0.201	0.142	0.138	0.384	0.463	0.505	0.585	0.486	0.332	0.263	0.435	0.505	0.46	0.154	0.204	0.217	0.219	0.222	0.216	0.198	0.0000
1790	1892	0.197	0.185	0.263	0.251	0.414	0.224	0.196	0.137	0.151	0.438	0.523	0.563	0.679	0.556	0.343	0.272	0.473	0.603	0.53	0.18	0.185	0.175	0.213	0.192	0.223	0.19	0.0000
1972	1659	0.205	0.208	0.227	0.218	0.21	0.105	0.14	0.113	0.026	0.124	0.154	0.18	0.22	0.204	0.197	0.206	0.147	0.21	0.196	0.024	0.155	0.15	0.166	0.164	0.164	0.212	0.0000
1982	2173	0.287	0.222	0.227	0.237	0.237	0.116	0.222	0.142	0.04	0.144	0.166	0.176	0.237	0.262	0.202	0.2	0.207	0.227	0.194	0.052	0.166	0.198	0.216	0.203	0.168	0.189	0.0000
1992	2060	0.282	0.237	0.237	0.239	0.243	0.122	0.217	0.125	0.036	0.148	0.169	0.178	0.262	0.27	0.203	0.207	0.238	0.227	0.207	0.039	0.18	0.202	0.226	0.193	0.174	0.18	0.0000
2002	1686	0.345	0.241	0.272	0.313	0.412	0.013	0.086	0.117	0.076	0.195	0.189	0.293	0.241	0.36	0.194	0.169	0.086	0.37	0.272	0.174	0.096	0.003	0.06	0.117	0.05	0.05	0.0000
2012	2094	0.359	0.234	0.316	0.295	0.387	0.071	0.149	0.135	0.06	0.192	0.227	0.313	0.27	0.323	0.195	0.202	0.099	0.38	0.274	0.177	0.106	0.131	0.085	0.185	0.099	0.113	0.0000
2022	2402	0.305	0.228	0.27	0.259	0.24	0.147	0.204	0.151	0.121	0.192	0.242	0.263	0.276	0.302	0.247	0.231	0.223	0.267	0.23	0.119	0.191	0.223	0.211	0.23	0.21	0.205	0.0000
2032	2464	0.311	0.225	0.279	0.261	0.241	0.151	0.208	0.151	0.104	0.178	0.221	0.254	0.257	0.283	0.233	0.215	0.219	0.254	0.233	0.11	0.197	0.235	0.221	0.237	0.223	0.209	0.0000
2042	2486	0.32	0.219	0.263	0.283	0.286	0.138	0.217	0.168	0.086	0.216	0.217	0.248	0.295	0.277	0.219	0.215	0.227	0.286	0.268	0.101	0.203	0.236	0.233	0.245	0.23	0.219	0.0000
2052	2552	0.343	0.231	0.276	0.312	0.334	0.151	0.223	0.191	0.106	0.27	0.252	0.289	0.347	0.322	0.246	0.237	0.248	0.335	0.313	0.11	0.21	0.238	0.243	0.248	0.24	0.228	0.0000
2063	2579	0.376	0.253	0.296	0.298	0.335	0.17	0.238	0.172	0.116	0.25	0.281	0.311	0.341	0.359	0.266	0.265	0.299	0.333	0.32	0.108	0.216	0.232	0.243	0.24	0.23	0.229	0.0000
2073	2433	0.346	0.241	0.28	0.297	0.318	0.167	0.23	0.168	0.115	0.243	0.275	0.301	0.337	0.342	0.264	0.253	0.298	0.313	0.316	0.103	0.201	0.232	0.236	0.243	0.228	0.217	0.0000
2083	2558	0.314	0.224	0.278	0.273	0.289	0.164	0.226	0.159	0.085	0.232	0.27	0.304	0.332	0.319	0.263	0.229	0.263	0.327	0.292	0.101	0.201	0.243	0.232	0.251	0.228	0.224	0.0000
2093	2516	0.319	0.241	0.278	0.284	0.296	0.164	0.231	0.167	0.089	0.242	0.286	0.319	0.344	0.34	0.27	0.236	0.27	0.32	0.308	0.095	0.209	0.239	0.237	0.257	0.233	0.226	0.0000

2103	2438	0.318	0.223	0.283	0.279	0.304	0.169	0.213	0.179	0.105	0.239	0.296	0.313	0.381	0.349	0.269	0.224	0.296	0.313	0.318	0.111	0.22	0.259	0.257	0.26	0.255	0.238	0.0000
2113	2374	0.305	0.224	0.28	0.267	0.29	0.17	0.217	0.167	0.104	0.238	0.286	0.314	0.377	0.344	0.267	0.224	0.301	0.311	0.316	0.109	0.222	0.254	0.249	0.254	0.247	0.231	0.0000
2123	2380	0.3	0.21	0.263	0.259	0.28	0.142	0.213	0.142	0.089	0.228	0.262	0.291	0.353	0.305	0.246	0.203	0.289	0.321	0.294	0.1	0.202	0.233	0.222	0.232	0.219	0.218	0.0000
2133	2378	0.297	0.204	0.257	0.26	0.272	0.142	0.21	0.144	0.087	0.233	0.267	0.296	0.352	0.31	0.238	0.206	0.285	0.323	0.296	0.097	0.199	0.234	0.225	0.239	0.227	0.207	0.0000
2143	2400	0.303	0.219	0.244	0.259	0.284	0.158	0.198	0.159	0.108	0.249	0.289	0.315	0.364	0.325	0.26	0.221	0.315	0.336	0.321	0.115	0.2	0.24	0.231	0.238	0.225	0.218	0.0000
2153	2404	0.308	0.217	0.241	0.254	0.285	0.163	0.194	0.154	0.11	0.253	0.3	0.326	0.375	0.341	0.26	0.227	0.334	0.348	0.33	0.116	0.203	0.242	0.227	0.23	0.22	0.215	0.0000
2163	2306	0.28	0.208	0.244	0.234	0.281	0.148	0.194	0.148	0.084	0.26	0.296	0.342	0.377	0.347	0.255	0.211	0.311	0.341	0.33	0.112	0.195	0.22	0.219	0.228	0.226	0.212	0.0000
2174	2235	0.27	0.208	0.239	0.237	0.283	0.15	0.196	0.146	0.086	0.262	0.297	0.334	0.39	0.34	0.255	0.206	0.318	0.342	0.326	0.114	0.188	0.222	0.216	0.227	0.23	0.208	0.0000
2184	2313	0.281	0.217	0.25	0.247	0.287	0.164	0.212	0.152	0.116	0.267	0.312	0.358	0.382	0.353	0.266	0.214	0.322	0.376	0.327	0.136	0.191	0.227	0.221	0.239	0.224	0.213	0.0000
2194	2292	0.276	0.214	0.247	0.242	0.282	0.163	0.212	0.151	0.116	0.269	0.312	0.362	0.388	0.354	0.257	0.22	0.306	0.36	0.332	0.135	0.18	0.225	0.21	0.232	0.218	0.212	0.0000
2204	2254	0.28	0.198	0.237	0.239	0.262	0.161	0.202	0.162	0.097	0.261	0.307	0.35	0.401	0.337	0.243	0.221	0.307	0.366	0.324	0.109	0.198	0.226	0.215	0.234	0.217	0.209	0.0000
2214	2252	0.272	0.197	0.232	0.232	0.256	0.161	0.199	0.155	0.098	0.258	0.303	0.341	0.383	0.327	0.236	0.216	0.3	0.351	0.314	0.11	0.203	0.23	0.212	0.243	0.225	0.204	0.0000
2224	2271	0.273	0.207	0.242	0.237	0.271	0.159	0.194	0.136	0.1	0.237	0.285	0.313	0.366	0.322	0.241	0.212	0.287	0.347	0.32	0.117	0.19	0.224	0.206	0.224	0.212	0.193	0.0000
2234	2253	0.275	0.202	0.232	0.231	0.265	0.153	0.191	0.136	0.096	0.244	0.287	0.314	0.367	0.326	0.236	0.214	0.287	0.334	0.32	0.111	0.192	0.217	0.208	0.22	0.209	0.202	0.0000
2244	2035	0.257	0.185	0.219	0.22	0.258	0.144	0.182	0.132	0.091	0.239	0.284	0.314	0.374	0.335	0.236	0.199	0.273	0.338	0.291	0.094	0.167	0.194	0.186	0.196	0.182	0.184	0.0000
2254	2042	0.248	0.184	0.216	0.215	0.258	0.133	0.177	0.125	0.088	0.241	0.28	0.317	0.358	0.323	0.229	0.196	0.27	0.33	0.298	0.092	0.159	0.191	0.18	0.2	0.175	0.183	0.0000
2264	2118	0.252	0.178	0.226	0.224	0.264	0.154	0.182	0.135	0.091	0.246	0.282	0.306	0.369	0.324	0.24	0.197	0.275	0.329	0.29	0.1	0.179	0.185	0.192	0.202	0.199	0.192	0.0000
2274	2076	0.251	0.183	0.225	0.215	0.247	0.15	0.181	0.137	0.091	0.24	0.273	0.294	0.357	0.316	0.234	0.192	0.266	0.325	0.29	0.101	0.17	0.185	0.183	0.19	0.192	0.195	0.0000
2285	2048	0.246	0.184	0.214	0.215	0.251	0.143	0.17	0.131	0.084	0.224	0.267	0.298	0.338	0.286	0.229	0.182	0.262	0.31	0.287	0.095	0.168	0.2	0.192	0.189	0.168	0.181	0.0000
2295	2035	0.24	0.18	0.221	0.219	0.253	0.142	0.174	0.135	0.079	0.226	0.268	0.286	0.335	0.285	0.237	0.186	0.267	0.313	0.285	0.098	0.163	0.191	0.204	0.185	0.147	0.184	0.0000
2305	2107	0.23	0.175	0.206	0.208	0.253	0.129	0.173	0.126	0.086	0.203	0.253	0.281	0.344	0.292	0.217	0.173	0.271	0.308	0.291	0.1	0.164	0.194	0.164	0.19	0.172	0.171	0.0000
2315	2082	0.229	0.164	0.208	0.208	0.259	0.136	0.161	0.126	0.086	0.204	0.242	0.293	0.354	0.292	0.214	0.171	0.274	0.321	0.291	0.103	0.167	0.201	0.154	0.196	0.184	0.171	0.0000
2325	1976	0.229	0.178	0.213	0.202	0.26	0.135	0.168	0.132	0.087	0.234	0.251	0.288	0.338	0.298	0.229	0.178	0.262	0.331	0.283	0.086	0.162	0.188	0.168	0.197	0.184	0.189	0.0000
2335	2016	0.23	0.18	0.219	0.192	0.25	0.136	0.164	0.135	0.082	0.229	0.238	0.296	0.328	0.292	0.225	0.17	0.257	0.32	0.274	0.084	0.141	0.188	0.153	0.182	0.167	0.188	0.0000
2345	1975	0.205	0.181	0.178	0.19	0.239	0.109	0.195	0.114	0.09	0.2	0.279	0.288	0.318	0.314	0.206	0.193	0.273	0.333	0.293	0.119	0.165	0.175	0.209	0.176	0.149	0.182	0.0000
2355	1657	0.191	0.166	0.176	0.197	0.229	0.097	0.188	0.116	0.077	0.176	0.282	0.275	0.277	0.302	0.192	0.18	0.285	0.312	0.295	0.123	0.142	0.184	0.203	0.176	0.159	0.198	0.0000
2365	1625	0.2	0.108	0.138	0.165	0.178	0.154	0.104	0.108	0.046	0.191	0.183	0.212	0.298	0.201	0.193	0.142	0.235	0.267	0.208	0.1	0.142	0.153	0.185	0.175	0.128	0.156	0.0000
2375	1269	0.153	0.045	0.101	0.154	0.122	0.145	0.072	0.13	0.033	0.182	0.159	0.171	0.271	0.135	0.185	0.121	0.203	0.24	0.187	0.125	0.161	0.163	0.184	0.177	0.148	0.142	0.0000
2385	2346	-0.02	0.05	0.186	0.127	0.168	0.208	0.22	0.097	0.013	0.021	0.192	0.238	0.385	0.33	0.06	0.108	0.142	0.315	0.103	0.112	0.067	-0.01	0.021	0.177	0.211	0.069	0.0000
2396	2614	-0.02	0.048	0.131	0.085	0.109	0.14	0.154	0.131	-0.02	0.011	0.116	0.217	0.245	0.255	0.028	0.125	0.107	0.238	0.047	0.079	0.042	-0.05	-0.03	0.173	0.19	0.054	0.0000
2406	-947	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	0.0000
2416	-696	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	0.0000
2426	-442	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	0.0000
2436	-251	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	0.0000
2446	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
2456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
2466	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000
	266	**268**	**269**	**270**	**271**	**272**	**276**	**277**	**280**	**281**	**282**	**283**	**284**	**286**	**287**	**288**	**292**	**294**	**295**	**296**	**298**	**299**	**300**	**301**	**302**	**304**	**305**	
TP (mg/l)	0.062	0.052	0.067	0.088	0.071	0.074	0.056	0.049	0.08	0.126	0.127	0.162	0.064	0.049	0.167	0.123	0.064	0.043	0.141	0.338	0.471	0.248	0.098	0.447	0.26	0.057	0.07	

APPENDIX D-2

BANDS RATIO REGRESSIONS

MAY 12, 2006

Hyperion Reflectances 5-12-2006

782.95/Wavelength

	266	268	269	270	271	272	276	277	280	281	282	283	284	286	287	288	292	294	295	296	298	299	300	301	302	304	305	r
396	0.279	0.343	0.264	0.300	0.302	0.306	0.265	0.248	0.186	0.181	0.383	0.412	0.492	0.489	0.430	0.285	0.249	0.442	0.435	0.423	0.176	0.229	0.236	0.232	0.216	0.211	0.247	-0.204
406	-5.650	-6.937	-5.346	-6.063	-6.115	-6.188	-5.362	-5.014	-3.755	-3.660	-7.751	-8.342	-9.968	-9.903	-8.709	-5.777	-5.043	-8.953	-8.804	-8.559	-3.557	-4.630	-4.785	-4.702	-4.381	-4.275	-4.990	0.204
417	-6.161	-7.565	-5.830	-6.611	-6.669	-6.748	-5.848	-5.468	-4.095	-3.991	-8.453	-9.097	#####	#####	-9.497	-6.300	-5.499	-9.764	-9.600	-9.333	-3.879	-5.049	-5.219	-5.128	-4.777	-4.662	-5.442	0.204
427	4.524	4.924	4.674	4.497	4.655	4.430	4.520	4.886	5.255	6.088	4.231	4.121	4.619	4.352	4.611	4.694	4.856	4.188	3.997	4.404	4.576	6.099	6.000	6.295	5.725	6.212	4.990	0.247
437	2.960	3.022	2.961	2.825	2.751	2.734	3.227	2.981	2.944	3.008	2.630	2.444	2.719	2.573	2.790	3.095	3.133	2.597	2.452	2.712	3.154	3.870	4.354	3.840	3.577	3.792	3.101	0.275
447	1.988	1.937	1.987	1.865	1.925	1.870	2.215	2.035	2.120	2.205	1.766	1.681	1.837	1.715	1.874	2.089	2.151	1.713	1.664	1.848	2.250	2.614	2.733	2.752	2.844	2.708	1.978	0.385
457	1.518	1.437	1.489	1.440	1.405	1.415	1.621	1.498	1.592	1.609	1.298	1.289	1.383	1.314	1.396	1.566	1.607	1.301	1.270	1.372	1.728	1.912	2.049	2.015	1.948	1.959	1.526	0.392
468	1.187	1.153	1.149	1.145	1.134	1.138	1.264	1.208	1.278	1.321	1.084	1.086	1.114	1.064	1.139	1.276	1.253	1.060	1.044	1.130	1.324	1.542	1.594	1.602	1.572	1.543	1.215	0.415
478	1.161	1.144	1.159	1.133	1.112	1.166	1.271	1.168	1.224	1.298	1.103	1.086	1.140	1.094	1.172	1.271	1.241	1.114	1.051	1.152	1.324	1.459	1.509	1.487	1.511	1.495	1.201	0.420
488	1.136	1.116	1.115	1.102	1.089	1.135	1.285	1.120	1.230	1.271	1.092	1.068	1.130	1.083	1.164	1.245	1.233	1.082	1.049	1.137	1.354	1.440	1.452	1.421	1.447	1.434	1.179	0.459
498	1.089	1.109	1.090	1.066	1.057	1.110	1.216	1.106	1.182	1.251	1.078	1.055	1.104	1.086	1.143	1.203	1.166	1.080	1.031	1.116	1.296	1.327	1.388	1.384	1.353	1.361	1.151	0.482
508	1.058	1.063	1.054	1.046	1.013	1.082	1.184	1.072	1.141	1.234	1.063	1.048	1.083	1.065	1.118	1.209	1.140	1.051	1.024	1.093	1.248	1.294	1.302	1.311	1.296	1.291	1.095	0.501
518	1.052	1.034	1.027	1.015	0.993	1.052	1.155	1.033	1.091	1.200	1.037	1.034	1.071	1.060	1.095	1.162	1.096	1.041	1.004	1.070	1.215	1.251	1.246	1.236	1.230	1.244	1.057	0.496
529	1.041	1.022	1.005	1.018	0.976	1.051	1.149	1.041	1.078	1.170	1.046	1.025	1.063	1.044	1.100	1.169	1.093	1.043	1.010	1.070	1.224	1.193	1.228	1.227	1.207	1.192	1.046	0.555
539	1.024	1.020	1.001	1.001	0.965	1.036	1.147	1.027	1.072	1.172	1.049	1.022	1.062	1.043	1.096	1.148	1.075	1.038	1.010	1.069	1.205	1.164	1.189	1.208	1.178	1.187	1.037	0.555
549	1.011	0.997	0.997	0.985	0.951	1.030	1.130	1.008	1.069	1.165	1.027	1.022	1.051	1.045	1.081	1.142	1.052	1.035	1.000	1.055	1.213	1.128	1.151	1.173	1.152	1.153	1.020	0.571
559	1.000	0.997	0.979	0.974	0.944	1.022	1.119	1.010	1.046	1.160	1.046	1.026	1.058	1.051	1.092	1.140	1.046	1.042	1.011	1.065	1.203	1.115	1.139	1.143	1.132	1.120	1.009	0.579
569	0.986	0.979	0.976	0.974	0.941	1.015	1.107	0.999	1.035	1.152	1.037	1.030	1.044	1.047	1.090	1.136	1.035	1.050	1.010	1.067	1.213	1.087	1.107	1.120	1.107	1.106	0.998	0.597
579	0.981	0.974	0.966	0.966	0.925	1.004	1.117	0.977	1.031	1.159	1.035	1.020	1.043	1.046	1.076	1.133	1.024	1.037	1.006	1.057	1.198	1.081	1.077	1.099	1.087	1.095	0.992	0.553
590	0.977	0.972	0.960	0.954	0.934	1.014	1.111	0.992	1.049	1.166	1.037	1.020	1.044	1.049	1.081	1.143	1.035	1.043	1.014	1.057	1.227	1.070	1.070	1.070	1.088	1.071	0.992	0.532
600	0.978	0.965	0.958	0.963	0.924	0.990	1.095	0.971	1.021	1.169	1.017	1.013	1.026	1.041	1.069	1.114	1.011	1.024	0.997	1.036	1.166	1.042	1.043	1.061	1.049	1.060	0.981	0.481
610	0.965	0.958	0.946	0.951	0.921	1.001	1.113	0.959	1.056	1.159	1.025	1.021	1.039	1.047	1.077	1.116	1.018	1.035	1.009	1.046	1.196	1.018	1.019	1.040	1.026	1.027	0.966	0.451
620	0.974	0.970	0.961	0.960	0.924	1.004	1.123	0.977	1.031	1.174	1.040	1.031	1.046	1.055	1.084	1.138	1.024	1.047	1.021	1.066	1.206	1.021	1.033	1.050	1.036	1.037	0.961	0.461
630	0.966	0.967	0.949	0.951	0.925	1.005	1.123	0.972	1.041	1.159	1.038	1.029	1.040	1.051	1.087	1.122	1.020	1.040	1.016	1.054	1.205	1.016	1.022	1.032	1.038	1.039	0.961	0.445
641	0.963	0.962	0.961	0.952	0.920	1.010	1.124	0.958	1.033	1.165	1.037	1.024	1.037	1.049	1.081	1.129	1.022	1.035	1.019	1.047	1.230	1.011	1.013	1.030	1.015	1.011	0.971	0.451
651	0.942	0.932	0.928	0.925	0.902	0.992	1.088	0.951	1.018	1.149	1.011	1.009	1.017	1.038	1.066	1.117	1.000	1.027	1.001	1.035	1.192	0.983	0.999	1.007	0.995	1.014	0.946	0.418
661	0.943	0.939	0.938	0.923	0.907	0.979	1.099	0.944	1.021	1.156	1.014	1.000	1.006	1.033	1.053	1.100	0.998	1.016	0.991	1.022	1.187	0.994	0.991	0.999	0.977	0.999	0.928	0.400
671	0.948	0.941	0.934	0.931	0.910	1.003	1.114	0.938	1.021	1.172	1.019	1.013	1.023	1.038	1.065	1.106	1.012	1.032	1.015	1.039	1.203	0.978	0.978	0.996	1.006	0.996	0.939	0.392
681	0.933	0.933	0.923	0.925	0.905	0.995	1.109	0.940	1.036	1.160	1.019	1.015	1.016	1.037	1.063	1.110	1.011	1.028	1.006	1.032	1.209	0.967	0.977	1.003	0.979	0.986	0.928	0.397
691	0.930	0.917	0.919	0.916	0.915	0.998	1.076	0.938	1.016	1.143	1.016	1.014	1.018	1.036	1.058	1.101	0.996	1.030	1.000	1.032	1.179	0.966	0.972	0.996	0.977	0.994	0.934	0.397
702	0.940	0.925	0.919	0.926	0.914	0.964	1.056	0.930	1.011	1.113	0.980	0.974	0.978	1.002	1.026	1.057	0.974	0.995	0.964	0.997	1.154	0.957	0.956	0.967	0.970	0.967	0.941	0.404
712	0.967	0.953	0.950	0.950	0.942	0.981	1.054	0.973	1.034	1.117	0.994	0.997	0.988	0.999	1.026	1.068	1.004	1.000	0.982	1.001	1.151	0.993	0.987	1.014	1.001	1.012	0.985	0.462
722	0.988	0.965	0.978	0.963	0.955	0.967	0.999	0.989	1.028	1.048	0.932	0.926	0.927	0.942	0.962	1.005	0.993	0.943	0.924	0.941	1.085	0.994	1.006	1.018	0.997	1.011	0.977	0.378
732	1.001	0.985	0.981	0.968	0.949	0.949	0.982	0.979	0.987	1.020	0.946	0.933	0.933	0.934	0.956	0.983	0.980	0.935	0.927	0.940	1.034	0.978	0.978	0.991	0.977	0.966	0.968	0.310
742	1.004	0.990	0.997	0.993	0.983	0.993	1.015	0.998	1.004	1.028	1.006	0.993	0.994	1.002	0.994	1.011	0.992	0.995	0.987	1.004	1.045	0.977	0.995	1.015	1.002	1.002	0.990	0.487
752	1.013	0.990	1.002	0.996	1.000	1.007	1.012	1.015	1.038	1.026	1.024	1.015	1.011	1.025	1.021	1.020	1.018	1.013	1.016	1.021	1.062	1.001	1.021	1.017	1.018	1.013	0.999	0.488
763	1.017	1.010	1.025	1.014	1.007	0.997	1.000	1.016	1.020	1.007	0.995	0.999	1.000	1.000	1.008	1.006	1.016	0.990	0.984	0.998	1.029	0.997	1.012	1.021	1.018	1.022	1.010	0.215
773	0.988	0.985	0.984	0.970	0.967	0.972	0.970	0.983	0.971	0.980	0.985	0.982	0.978	0.985	0.985	0.980	0.981	0.968	0.968	0.971	0.989	0.947	0.960	0.981	0.968	0.971	0.968	0.024
783	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	#####
793	1.022	1.008	1.010	1.003	0.992	0.975	0.985	1.012	1.011	0.999	0.994	0.985	0.990	1.001	0.997	1.001	0.996	0.992	0.988	0.997	1.011	0.994	1.004	1.010	0.994	0.989	1.001	0.158
803	1.006	0.999	1.002	0.999	0.984	0.977	0.978	1.000	1.010	0.996	0.988	0.981	0.977	0.982	0.982	0.981	0.985	0.982	0.969	0.975	1.006	0.993	0.995	1.000	0.980	0.978	0.979	0.154
813	1.015	1.003	1.015	1.004	0.999	0.978	0.962	1.022	1.018	0.983	0.947	0.958	0.951	0.964	0.980	0.976	0.998	0.976	0.957	0.957	1.022	0.994	0.997	1.003	1.007	0.995	1.023	0.073
824	0.999	0.989	0.995	0.992	0.973	0.938	0.924	0.981	0.979	0.954	0.920	0.919	0.902	0.919	0.924	0.913	0.944	0.918	0.902	0.918	0.953	0.961	0.963	0.981	0.934	0.947	0.985	-0.060
834	1.005	0.985	1.001	0.978	0.971	0.944	0.943	0.982	0.973	0.984	0.938	0.926	0.930	0.936	0.942	0.924	0.955	0.938	0.922	0.933	0.950	0.939	0.970	0.981	0.933	0.914	0.961	-0.126
844	0.996	0.978	0.985	0.979	0.978	0.966	0.979	0.988	0.968	0.948	0.964	0.965	0.965	0.980	0.966	0.963	0.967	0.981	0.962	0.969	0.997	0.957	0.949	0.966	0.942	0.951	0.981	-0.084
854	0.998	0.986	0.992	0.960	0.976	0.968	0.943	1.002	0.967	0.960	0.992	0.970	0.967	0.981	0.964	0.956	0.965	0.981	0.958	0.981	0.978	0.946	0.957	0.968	0.946	0.931	0.977	-0.090
864	1.005	0.986	0.997	0.967	0.988	0.971	0.985	0.999	0.987	0.940	0.978	0.981	0.985	0.999	0.973	0.956	0.972	0.982	0.982	0.974	0.951	0.943	0.944	0.959	0.935	0.919	0.984	-0.418
875	0.987	0.984	0.997	0.984	0.989	0.970	0.957	0.983	0.990	0.955	0.973	0.982	0.970	0.985	0.961	0.946	0.986	0.991	0.981	0.978	0.947	0.947	0.963	0.958	0.940	0.938	0.969	-0.458
885	0.990	0.977	0.981	0.968	0.981	0.951	0.939	0.970	0.956	0.938	0.961	0.946	0.948	0.961	0.944	0.926	0.951	0.949	0.967	0.948	0.939	0.935	0.924	0.960	0.923	0.936	0.982	-0.311
895	1.133	1.147	1.141	1.145	1.161	1.120	1.049	1.133	1.173	1.095	1.080	1.079	1.052	1.083	1.101	1.094	1.113	1.097	1.068	1.076	1.099	1.103	1.077	1.120	1.080	1.081	1.160	-0.176
905	1.319	1.364	1.347	1.361	1.383	1.308	1.165	1.336	1.268	1.236	1.187	1.159	1.153	1.180	1.174	1.219	1.254	1.217	1.166	1.172	1.207	1.265	1.231	1.228	1.215	1.186	1.307	-0.302
915	1.687	1.587	1.614	1.552	1.655	1.460	1.445	1.695	1.777	1.379	1.371	1.401	1.417	1.391	1.390	1.331	1.507	1.371	1.397	1.342	1.320	1.579	1.591	1.562	1.419	1.420	1.627	-0.308
925	1.926	1.898	1.892	1.909	1.911	1.856	1.633	1.898	1.727	1.611	1.687	1.709	1.824	1.783	1.715	1.740	1.896	1.689	1.758	1.644	1.539	1.940	1.788	1.970	1.764	1.596	2.052	-0.211
936	-2.159	-2.650	-2.043	-2.316	-2.336	-2.364	-2.049	-1.916	-1.435	-1.398	-2.961	-3.187	-3.808	-3.783	-3.327	-2.207	-1.927	-3.421	-3.363	-3.270	-1.359	-1.769	-1.828	-1.797	-1.674	-1.633	-1.906	0.204
946	-3.094	-3.799	-2.928	-3.320	-3.349	-3.389	-2.937	-2.746	-2.057	-2.004	-4.245	-4.569	-5.459	-5.424	-4.769	-3.164	-2.762	-4.904	-4.822	-4.687	-1.948	-2.535	-2.621	-2.575	-2.399	-2.341	-2.733	0.204
956	-5.188	-6.370	-4.909	-5.567	-5.615	-5.682	-4.924	-4.604	-3.448	-3.361	-7.117	-7.660	-9.152	-9.093	-7.996	-5.305	-4.630	-8.221	-8.084	-7.859	-3.266	-4.251	-4.394	-4.318	-4.022	-3.926	-4.582	0.204
966	#####	#####	#####	#####	#####	#####	#####	#####	-9.513	-9.272	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	-9.010	#####	#####	-	#####	#####	#####	0.204

																								11.913				
976	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
986	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
997	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
1007	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
1017	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
1027	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
1037	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
1048	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
1058	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
852	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
862	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
872	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	0.116
882	-4.636	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	0.116
892	-3.230	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	0.116
902	-2.187	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	0.116
912	1.974	1.725	1.635	1.748	1.799	1.478	2.171	2.433	1.588	2.160	1.884	1.889	2.053	1.515	1.638	1.630	1.763	1.808	1.718	1.749	1.859	2.803	1.998	2.127	1.939	1.471	2.059	0.220
923	1.602	1.407	1.387	1.481	1.477	1.139	1.698	2.054	1.555	1.868	1.551	1.523	1.638	1.351	1.358	1.350	1.504	1.401	1.251	1.458	1.448	1.797	1.939	1.567	1.565	1.348	1.658	-0.012
933	1.536	1.783	1.381	1.980	1.274	0.799	1.680	1.007	2.517	1.560	1.358	1.025	1.318	0.842	1.085	1.094	1.184	1.193	0.888	1.123	0.619	1.156	2.254	2.307	1.648	2.048	1.340	-0.077
943	1.284	1.264	1.087	1.396	1.110	0.654	1.354	0.968	1.673	1.363	1.030	0.842	1.044	0.627	0.863	0.855	1.073	0.906	0.665	0.981	0.527	0.987	1.449	1.855	1.683	1.289	1.238	0.036
953	0.986	0.901	0.861	0.835	1.178	0.522	0.913	1.028	0.693	1.345	0.743	0.691	0.859	0.579	0.708	0.718	0.812	0.794	0.676	0.766	0.948	1.138	0.968	1.018	0.849	1.159	0.907	0.102
963	0.939	0.876	0.985	0.888	1.042	0.668	1.026	0.910	0.781	1.051	0.862	0.766	0.950	0.738	0.781	0.779	0.806	0.888	0.808	0.854	0.974	0.987	0.909	0.952	0.912	0.989	0.921	0.131
973	0.965	0.886	0.990	0.988	0.976	0.759	1.047	1.014	0.897	1.001	0.924	0.826	0.924	0.811	0.843	0.846	0.868	0.889	0.839	0.908	0.993	0.966	0.918	0.899	0.845	0.909	1.002	-0.009
983	0.943	0.901	0.970	0.943	0.946	0.759	1.071	0.929	0.875	1.000	0.942	0.861	0.961	0.864	0.858	0.828	0.851	0.923	0.854	0.911	0.964	0.909	0.897	0.877	0.811	0.882	0.950	-0.088
993	0.963	0.939	1.011	0.951	0.956	0.773	1.087	0.969	0.901	1.002	0.989	0.903	1.019	0.933	0.896	0.853	0.910	0.973	0.880	0.952	0.921	0.961	0.894	0.936	0.861	0.868	0.925	-0.118
1003	0.976	0.956	1.019	0.964	0.950	0.786	1.096	0.979	0.951	1.060	1.022	0.955	1.060	0.943	0.922	0.875	0.932	0.963	0.875	0.960	0.927	0.937	0.890	0.923	0.844	0.870	0.923	-0.189
1013	0.973	0.980	1.016	0.942	0.969	0.817	1.172	0.976	0.883	0.976	1.026	0.927	1.036	0.946	0.897	0.883	0.906	0.989	0.929	0.976	0.983	0.942	0.907	0.954	0.887	0.885	0.952	-0.053
1023	0.964	0.984	1.009	0.948	0.994	0.812	1.126	0.970	0.906	1.002	1.058	0.942	1.047	0.946	0.920	0.881	0.933	0.991	0.928	0.975	0.961	0.930	0.918	0.968	0.909	0.913	0.947	-0.082
1034	0.987	0.980	1.028	1.012	1.002	0.808	1.073	1.005	0.890	1.007	1.016	0.958	1.053	0.970	0.899	0.892	0.909	1.010	0.940	1.008	0.974	0.974	0.916	0.952	0.869	0.898	0.952	-0.077
1044	1.016	0.990	1.028	1.004	1.002	0.823	1.097	1.009	0.903	1.007	1.025	0.948	1.055	0.982	0.919	0.888	0.930	1.030	0.955	1.028	0.968	0.992	0.944	0.979	0.898	0.892	0.966	-0.057
1054	1.035	0.999	1.083	1.003	1.011	0.836	1.184	1.045	0.955	1.053	1.050	0.968	1.067	0.976	0.958	0.902	0.946	1.009	0.972	0.984	1.032	0.961	0.943	1.014	0.930	0.945	0.985	-0.052
1064	1.069	1.027	1.122	1.021	1.060	0.855	1.194	1.114	0.966	1.090	1.073	0.971	1.087	1.002	0.983	0.907	0.973	1.051	0.998	1.020	1.062	0.991	0.981	1.034	0.960	0.979	1.020	-0.070
1074	1.081	1.092	1.165	1.090	1.110	0.884	1.246	1.128	1.024	1.144	1.130	1.036	1.152	1.037	1.013	0.960	1.043	1.067	1.016	1.072	1.083	1.073	1.002	1.041	0.956	1.025	1.057	-0.146
1084	1.127	1.133	1.209	1.100	1.153	0.901	1.287	1.163	1.062	1.158	1.134	1.045	1.167	1.052	1.020	0.952	1.083	1.092	1.028	1.093	1.123	1.117	1.054	1.088	0.989	1.056	1.112	-0.119
1094	1.135	1.142	1.196	1.123	1.128	0.936	1.293	1.171	1.045	1.165	1.098	0.996	1.106	1.014	1.000	0.955	1.065	1.056	0.983	1.034	1.132	1.096	1.053	1.114	1.019	1.065	1.172	-0.099
1104	1.176	1.181	1.191	1.198	1.175	0.868	1.258	1.235	1.049	1.134	1.024	0.923	1.022	0.957	0.951	0.927	1.081	0.997	0.896	0.996	1.151	1.226	1.210	1.196	1.121	1.120	1.227	0.039
1114	1.218	1.429	1.267	1.316	1.309	0.820	0.980	1.432	1.108	1.163	0.851	0.845	0.841	0.786	0.895	0.930	1.058	0.966	0.816	0.908	1.038	1.376	1.497	1.253	1.178	1.351	1.337	-0.065
1124	0.883	5.991	1.319	1.581	2.072	0.514	0.733	2.177	0.816	1.482	0.564	0.600	0.579	0.469	0.717	0.800	0.800	0.925	0.501	0.802	0.683	1.961	2.488	1.475	0.928	1.495	3.010	-0.174
1134	1.461	1.236	1.300	1.118	1.571	0.557	1.603	2.291	0.962	1.456	0.712	0.529	0.674	0.559	0.547	0.684	0.819	0.685	0.529	0.656	1.476	0.857	1.420	1.906	1.257	1.733	2.215	0.040
1144	1.480	1.196	1.407	0.980	1.496	0.561	1.437	2.570	0.860	1.128	0.687	0.554	0.675	0.564	0.549	0.696	0.827	0.701	0.529	0.665	1.175	0.852	1.647	2.022	1.245	2.386	1.805	-0.017
1155	1.127	1.112	1.262	1.108	1.133	0.686	1.125	1.131	0.942	1.085	0.889	0.719	0.850	0.729	0.735	0.765	0.921	0.804	0.687	0.785	0.859	0.988	0.991	1.037	0.933	0.889	0.958	-0.165
1165	1.065	1.062	1.183	1.043	1.105	0.792	1.142	1.073	0.968	1.184	0.996	0.861	0.980	0.854	0.884	0.837	0.986	0.937	0.824	0.900	0.973	0.987	0.977	0.993	0.902	0.893	0.990	-0.174
1175	1.072	1.066	1.141	1.042	1.057	0.833	1.151	1.043	0.952	1.113	1.025	0.925	1.043	0.918	0.910	0.873	0.988	0.974	0.907	0.945	1.070	0.940	0.938	0.941	0.877	0.881	0.974	-0.156
1185	1.083	1.075	1.141	1.055	1.031	0.807	1.150	1.078	0.970	1.108	1.025	0.932	1.037	0.905	0.907	0.862	0.960	0.987	0.887	0.965	1.077	0.951	0.920	0.959	0.886	0.903	0.980	-0.105
1195	1.046	1.022	1.060	1.030	1.039	0.853	1.175	1.043	0.950	1.172	0.995	0.914	1.026	0.905	0.917	0.865	0.968	1.005	0.878	0.959	1.044	0.986	0.951	0.945	0.902	0.941	0.984	-0.135
1205	1.054	1.054	1.084	1.031	1.054	0.856	1.214	1.037	0.934	1.155	1.033	0.939	1.042	0.940	0.928	0.871	0.958	1.013	0.902	0.985	1.073	0.999	0.933	0.951	0.888	0.913	1.013	-0.102
1215	1.050	1.039	1.108	1.056	1.053	0.871	1.245	1.077	0.993	1.152	1.080	1.001	1.110	0.984	0.980	0.921	1.013	1.065	0.957	1.051	1.088	1.017	0.974	1.048	0.945	0.964	1.067	-0.019
1225	1.024	1.029	1.100	1.022	1.032	0.866	1.228	1.088	0.991	1.146	1.105	1.003	1.113	1.009	0.985	0.930	1.004	1.056	0.975	1.050	1.083	0.993	0.954	1.009	0.921	0.932	1.025	-0.051
1235	1.032	1.043	1.076	1.026	1.027	0.895	1.217	1.059	0.981	1.150	1.111	1.003	1.111	0.983	0.991	0.928	1.022	1.063	0.977	1.020	1.050	0.967	0.935	0.962	0.896	0.909	1.010	-0.186
1245	1.057	1.037	1.087	1.041	1.046	0.889	1.234	1.060	0.986	1.143	1.106	1.005	1.094	0.994	0.975	0.906	0.993	1.067	0.982	1.025	1.071	0.966	0.933	0.976	0.898	0.897	1.019	-0.138
1255	1.028	1.038	1.060	1.017	1.040	0.864	1.242	1.059	0.997	1.173	1.111	1.007	1.106	1.002	0.982	0.906	0.964	1.060	0.988	1.016	1.100	0.938	0.917	0.963	0.899	0.895	1.008	-0.093
1266	1.041	1.034	1.089	1.020	1.070	0.872	1.242	1.050	0.972	1.146	1.096	0.973	1.069	0.994	0.956	0.897	0.928	1.071	0.974	1.038	1.099	0.964	0.932	0.978	0.937	0.914	1.044	-0.047
1276	1.065	1.046	1.124	1.053	1.091	0.913	1.239	1.067	1.019	1.171	1.146	1.039	1.152	1.017	1.022	0.931	1.016	1.100	0.998	1.053	1.055	1.007	0.952	0.991	0.895	0.934	1.033	-0.202
1286	1.126	1.094	1.173	1.057	1.116	0.926	1.270	1.132	1.013	1.201	1.137	1.034	1.153	1.032	1.023	0.946	1.042	1.105	1.011	1.080	1.062	1.029	0.961	1.011	0.931	0.960	1.049	-0.225
1296	1.151	1.122	1.182	1.099	1.100	0.920	1.264	1.078	1.061	1.215	1.133	1.022	1.122	1.025	1.005	0.964	1.051	1.105	0.990	1.071	1.077	1.028	1.000	1.043	0.964	0.984	1.068	-0.196
1306	1.128	1.150	1.193	1.088	1.092	0.887	1.221	1.090	1.100	1.228	1.091	0.987	1.107	0.964	0.995	0.932	1.071	1.055	0.918	1.020	1.045	1.029	1.018	1.038	0.945	0.966	1.063	-0.227
1316	1.149	1.106	1.183	1.123	1.152	0.863	1.210	1.131	1.009	1.177	0.997	0.936	1.042	0.910	0.948	0.893	1.011	0.968	0.882	0.923	1.091	0.999	0.990	1.013	0.938	0.945	1.073	-0.173
1326	1.227	1.125	1.194	1.191	1.178	0.827	1.146	1.226	1.037	1.142	0.911	0.867	0.945	0.806	0.875	0.836	0.986	0.924	0.842	0.893	1.229	1.041	1.004	1.091	1.029	1.017	1.114	0.049
1336	1.090	1.175	1.145	1.130	1.137	0.865	0.942	1.112	1.313	1.132	0.862	0.754	0.888	0.716	0.762	0.786	1.022	0.849	0.710	0.794	0.894	1.089	1.117	1.263	1.049	1.032	1.155	-0.046
1457	1.410	2.557	2.559	1.127	9.470	0.536	#####	2.758	5.779	-3.956	0.841	1.592	1.524	0.747	1.005	1.074	1.302	1.413	0.753	1.130	6.945	2.370	4.824	5.466	-4.756	4.293	#####	0.205

1467	1.299	10.480	7.005	1.465	9.324	0.547	-2.135	3.585	3.480	-1.673	0.797	2.908	2.763	0.732	1.160	1.362	1.319	1.459	0.757	1.065	#####	2.880	#####	-5.779	-2.105	-3.457	-2.398	-0.440
1477	2.774	1.669	1.111	1.443	0.884	0.822	1.875	0.974	0.919	2.152	1.130	0.866	1.209	0.872	0.782	0.606	0.836	0.951	0.600	0.869	1.173	1.133	1.314	1.063	1.003	0.780	1.128	-0.136
1488	1.298	1.235	1.132	1.194	1.012	0.991	1.653	1.076	0.979	1.679	1.323	1.120	1.356	1.055	1.045	0.814	0.965	1.189	0.902	1.168	1.270	1.088	1.166	1.075	0.937	0.883	1.060	-0.025
1498	1.117	1.148	1.133	1.133	1.157	1.078	1.408	1.131	1.059	1.607	1.497	1.345	1.485	1.218	1.224	1.071	1.037	1.447	1.218	1.292	1.417	1.102	1.020	1.079	0.935	0.964	1.099	0.063
1508	1.049	1.098	1.096	1.085	1.098	1.059	1.485	1.105	1.043	1.537	1.512	1.358	1.508	1.294	1.243	1.074	1.032	1.481	1.242	1.320	1.342	1.007	0.945	1.013	0.914	0.915	1.078	-0.008
1518	1.054	1.065	1.071	1.050	1.057	1.018	1.463	1.030	1.027	1.565	1.443	1.308	1.441	1.263	1.193	1.019	1.014	1.392	1.191	1.253	1.335	0.980	0.930	0.966	0.868	0.889	1.003	-0.003
1528	1.069	1.030	1.043	1.037	1.018	1.020	1.447	1.030	0.999	1.482	1.409	1.271	1.423	1.260	1.193	1.012	1.008	1.382	1.217	1.244	1.319	0.949	0.925	0.939	0.843	0.874	0.993	-0.016
1538	1.038	1.047	1.052	1.036	1.073	1.011	1.437	1.053	1.028	1.432	1.408	1.271	1.419	1.249	1.224	1.027	1.002	1.387	1.220	1.249	1.326	0.980	0.928	0.965	0.846	0.872	1.024	0.002
1548	1.052	1.069	1.060	1.048	1.067	1.018	1.434	1.058	1.029	1.438	1.429	1.273	1.415	1.239	1.223	1.032	1.020	1.377	1.208	1.241	1.270	1.000	0.912	0.956	0.848	0.882	1.014	-0.042
1558	1.078	1.039	1.041	1.067	1.063	1.032	1.442	1.053	1.035	1.406	1.379	1.233	1.349	1.247	1.175	1.009	0.979	1.325	1.204	1.238	1.272	0.975	0.887	0.926	0.830	0.872	1.015	-0.048
1568	1.066	1.055	1.019	1.076	1.080	1.030	1.411	1.074	1.036	1.392	1.348	1.207	1.335	1.254	1.147	0.991	0.962	1.294	1.187	1.207	1.211	0.970	0.874	0.924	0.824	0.872	1.004	-0.099
1578	1.014	1.039	1.032	1.035	1.074	1.007	1.359	1.083	1.021	1.419	1.353	1.200	1.348	1.217	1.161	0.969	0.981	1.317	1.146	1.194	1.298	0.983	0.901	0.934	0.842	0.887	1.052	-0.021
1588	1.015	1.071	1.017	1.050	1.057	1.008	1.391	1.087	1.035	1.365	1.331	1.164	1.310	1.204	1.161	0.970	0.981	1.284	1.133	1.178	1.251	0.999	0.910	0.928	0.836	0.883	1.039	-0.060
1599	1.073	1.071	1.079	1.063	1.037	1.017	1.385	1.051	1.047	1.348	1.306	1.196	1.293	1.174	1.146	0.996	1.013	1.277	1.144	1.170	1.234	0.955	0.906	0.941	0.842	0.878	1.073	-0.091
1609	1.052	1.089	1.065	1.042	1.025	0.997	1.388	1.049	1.041	1.309	1.268	1.180	1.269	1.161	1.129	0.988	0.998	1.262	1.101	1.149	1.186	0.954	0.903	0.927	0.845	0.860	1.064	-0.126
1619	1.088	1.012	1.109	1.021	1.046	0.963	1.384	1.059	1.009	1.362	1.324	1.162	1.268	1.175	1.131	0.968	1.010	1.228	1.124	1.131	1.197	0.946	0.894	0.925	0.811	0.843	1.025	-0.111
1629	1.102	1.048	1.128	1.027	1.035	0.989	1.342	1.085	1.005	1.334	1.255	1.148	1.244	1.144	1.099	0.971	0.991	1.227	1.139	1.124	1.211	0.965	0.911	0.935	0.828	0.851	1.017	-0.099
1639	1.026	1.066	1.111	1.040	1.064	0.968	1.330	1.082	1.055	1.306	1.273	1.132	1.244	1.150	1.064	0.952	0.996	1.208	1.105	1.104	1.186	0.969	0.887	0.902	0.837	0.866	1.019	-0.150
1649	1.029	1.072	1.111	1.046	1.050	0.960	1.331	1.108	1.037	1.257	1.256	1.120	1.237	1.139	1.068	0.947	0.985	1.204	1.099	1.116	1.174	0.976	0.888	0.924	0.826	0.870	1.036	-0.142
1659	1.070	1.065	1.114	1.065	1.073	0.960	1.352	1.064	0.986	1.325	1.205	1.110	1.193	1.149	1.059	0.972	0.986	1.224	1.060	1.093	1.208	0.931	0.894	0.924	0.817	0.826	1.031	-0.126
1669	1.039	1.072	1.093	1.071	1.101	0.971	1.359	1.075	0.982	1.331	1.203	1.105	1.189	1.122	1.055	0.973	0.976	1.243	1.067	1.124	1.181	0.963	0.903	0.937	0.842	0.862	1.057	-0.123
1679	1.071	1.060	1.134	1.072	1.067	0.956	1.330	1.092	1.014	1.318	1.217	1.106	1.198	1.114	1.070	0.959	0.980	1.208	1.062	1.085	1.174	0.972	0.888	0.919	0.848	0.847	1.047	-0.152
1689	1.071	1.059	1.147	1.069	1.075	0.953	1.363	1.094	1.015	1.321	1.201	1.103	1.210	1.102	1.076	0.943	0.987	1.250	1.066	1.106	1.203	1.017	0.935	0.952	0.862	0.888	1.060	-0.107
1699	1.088	1.086	1.128	1.091	1.137	0.949	1.350	1.101	1.060	1.370	1.227	1.127	1.210	1.123	1.077	0.955	1.019	1.154	1.054	1.063	1.182	0.963	0.901	0.920	0.835	0.840	1.037	-0.183
1710	1.115	1.106	1.147	1.090	1.122	0.981	1.363	1.125	1.036	1.287	1.199	1.110	1.191	1.099	1.072	0.954	1.034	1.173	1.041	1.070	1.213	0.991	0.905	0.942	0.850	0.863	1.065	-0.163
1720	1.152	1.117	1.153	1.106	1.119	0.998	1.383	1.114	1.065	1.365	1.257	1.121	1.204	1.107	1.095	0.969	1.058	1.195	1.078	1.093	1.194	0.985	0.928	0.933	0.846	0.879	1.064	-0.209
1730	1.119	1.132	1.179	1.121	1.126	0.985	1.430	1.125	1.081	1.391	1.266	1.122	1.219	1.115	1.103	0.991	1.047	1.208	1.086	1.096	1.235	1.000	0.968	0.968	0.869	0.902	1.075	-0.163
1740	1.210	1.166	1.201	1.188	1.178	1.006	1.423	1.149	1.120	1.457	1.242	1.142	1.212	1.143	1.111	1.005	1.051	1.223	1.080	1.133	1.208	1.065	0.975	0.983	0.932	0.937	1.112	-0.202
1750	1.213	1.205	1.225	1.183	1.195	1.002	1.419	1.174	1.120	1.471	1.238	1.127	1.213	1.110	1.100	1.004	1.071	1.214	1.081	1.098	1.213	1.076	0.960	1.005	0.900	0.931	1.126	-0.213
1760	1.201	1.159	1.208	1.182	1.188	0.978	1.380	1.178	1.197	1.477	1.183	1.098	1.193	1.102	1.047	0.951	1.055	1.141	1.032	1.073	1.237	1.054	1.020	1.022	0.916	0.967	1.133	-0.178
1770	1.232	1.139	1.192	1.206	1.195	0.896	1.242	1.169	1.223	1.410	1.111	1.029	1.090	0.970	0.953	0.899	1.027	1.030	0.937	0.961	1.227	1.029	1.001	0.986	0.913	0.964	1.138	-0.164
1780	1.282	1.280	1.293	1.124	1.169	0.833	1.193	1.232	1.305	1.313	0.997	0.890	0.976	0.836	0.886	0.860	0.947	1.017	0.862	0.920	1.145	1.119	1.090	1.060	0.977	0.979	1.246	-0.140
1790	1.475	1.743	1.431	1.141	1.205	0.738	1.181	1.261	1.352	1.194	0.875	0.788	0.875	0.721	0.774	0.832	0.915	0.935	0.721	0.798	0.977	1.239	1.350	1.090	1.128	0.949	1.301	-0.195
1972	1.682	1.675	1.270	1.318	1.383	1.458	2.535	1.774	1.637	7.063	3.093	2.683	2.737	2.222	2.105	1.447	1.209	3.017	2.074	2.160	7.351	1.473	1.575	1.400	1.319	1.287	1.165	0.356
1982	1.284	1.192	1.191	1.318	1.273	1.288	2.276	1.116	1.306	4.509	2.653	2.477	2.791	2.062	1.644	1.415	1.248	2.133	1.912	2.178	3.366	1.374	1.197	1.074	1.066	1.260	1.307	0.198
1992	1.355	1.215	1.116	1.266	1.262	1.256	2.166	1.143	1.483	5.022	2.592	2.440	2.763	1.868	1.594	1.404	1.201	1.858	1.912	2.039	4.540	1.273	1.169	1.027	1.122	1.212	1.372	0.294
2002	1.655	0.994	1.096	1.101	0.964	0.743	19.769	2.880	1.587	2.392	1.969	2.177	1.682	2.029	1.195	1.468	1.477	5.149	1.174	1.554	1.011	2.375	73.875	3.865	1.850	4.241	4.950	-0.097
2012	1.333	0.955	1.127	0.947	1.025	0.789	3.757	1.664	1.377	3.018	1.997	1.814	1.575	1.813	1.331	1.463	1.231	4.463	1.144	1.546	0.990	2.153	1.803	2.736	1.172	2.129	2.174	-0.058
2022	1.162	1.124	1.160	1.108	1.167	1.273	1.807	1.215	1.230	1.498	1.990	1.701	1.872	1.776	1.427	1.154	1.079	1.988	1.628	1.840	1.481	1.195	1.062	1.100	0.941	1.005	1.203	-0.004
2032	1.133	1.102	1.175	1.075	1.159	1.270	1.754	1.190	1.233	1.747	2.154	1.865	1.940	1.904	1.521	1.223	1.156	2.018	1.714	1.816	1.593	1.161	1.007	1.054	0.912	0.947	1.177	0.004
2042	1.123	1.073	1.204	1.137	1.068	1.070	1.915	1.143	1.105	2.100	1.773	1.896	1.985	1.659	1.555	1.302	1.158	1.948	1.519	1.576	1.745	1.124	1.004	0.998	0.882	0.918	1.127	0.023
2052	1.094	0.999	1.143	1.085	0.968	0.915	1.753	1.113	0.973	1.701	1.420	1.635	1.703	1.409	1.336	1.158	1.053	1.786	1.297	1.349	1.603	1.087	0.994	0.954	0.874	0.880	1.081	0.035
2063	1.082	0.911	1.045	1.012	1.014	0.913	1.562	1.043	1.080	1.555	1.533	1.469	1.582	1.434	1.200	1.073	0.940	1.479	1.306	1.323	1.625	1.059	1.018	0.957	0.903	0.917	1.075	0.128
2073	1.147	0.992	1.095	1.070	1.016	0.962	1.591	1.078	1.104	1.574	1.573	1.497	1.635	1.452	1.257	1.082	0.984	1.484	1.392	1.337	1.711	1.139	1.019	0.985	0.892	0.925	1.136	0.138
2083	1.091	1.091	1.178	1.077	1.108	1.059	1.611	1.098	1.166	2.140	1.652	1.525	1.621	1.475	1.350	1.084	1.090	1.680	1.329	1.448	1.745	1.140	0.973	1.002	0.864	0.926	1.101	0.094
2093	1.109	1.074	1.097	1.079	1.063	1.032	1.619	1.073	1.111	2.027	1.581	1.443	1.546	1.423	1.266	1.058	1.058	1.639	1.360	1.371	1.846	1.097	0.991	0.981	0.843	0.908	1.090	0.133
2103	1.145	1.076	1.184	1.059	1.082	1.007	1.572	1.164	1.039	1.722	1.599	1.395	1.574	1.285	1.233	1.062	1.111	1.494	1.390	1.329	1.586	1.041	0.915	0.902	0.831	0.830	1.034	0.025
2113	1.176	1.124	1.181	1.071	1.132	1.054	1.555	1.143	1.114	1.737	1.608	1.441	1.567	1.299	1.249	1.067	1.114	1.469	1.397	1.338	1.608	1.030	0.930	0.934	0.851	0.855	1.066	0.032
2123	1.173	1.142	1.261	1.140	1.165	1.091	1.872	1.166	1.304	2.029	1.678	1.575	1.690	1.387	1.409	1.161	1.225	1.533	1.357	1.437	1.752	1.133	1.016	1.049	0.934	0.966	1.130	0.064
2133	1.174	1.152	1.293	1.164	1.161	1.124	1.860	1.178	1.290	2.073	1.645	1.542	1.666	1.389	1.389	1.200	1.212	1.554	1.345	1.430	1.809	1.150	1.009	1.034	0.905	0.932	1.193	0.067
2143	1.163	1.130	1.206	1.228	1.167	1.075	1.674	1.251	1.167	1.671	1.539	1.427	1.562	1.342	1.324	1.098	1.129	1.406	1.296	1.319	1.525	1.146	0.985	1.008	0.909	0.938	1.133	-0.011
2153	1.161	1.112	1.215	1.245	1.188	1.074	1.628	1.277	1.205	1.650	1.516	1.375	1.509	1.305	1.262	1.096	1.100	1.325	1.249	1.281	1.519	1.127	0.976	1.025	0.940	0.960	1.149	-0.002
2163	1.210	1.225	1.272	1.230	1.289	1.089	1.792	1.275	1.258	2.152	1.472	1.392	1.439	1.296	1.239	1.120	1.178	1.424	1.276	1.282	1.566	1.173	1.075	1.059	0.950	0.935	1.164	-0.031
2174	1.249	1.271	1.273	1.253	1.274	1.081	1.766	1.263	1.267	2.105	1.463	1.388	1.473	1.255	1.267	1.119	1.212	1.393	1.271	1.297	1.547	1.219	1.066	1.075	0.953	0.920	1.183	-0.023
2184	1.207	1.219	1.220	1.200	1.224	1.064	1.613	1.169	1.223	1.561	1.436	1.319	1.377	1.280	1.219	1.071	1.165	1.374	1.157	1.295	1.291	1.198	1.040	1.049	0.905	0.942	1.159	-0.133
2194	1.218	1.243	1.233	1.212	1.247	1.084	1.623	1.171	1.233	1.556	1.422	1.320	1.359	1.260	1.215	1.112	1.130	1.445	1.209	1.273	1.304	1.271	1.053	1.108	0.932	0.969	1.161	-0.102
2204	1.238	1.223	1.334	1.266	1.263	1.167	1.649	1.225	1.143	1.866	1.469	1.344	1.407	1.221	1.277	1.176	1.125	1.440	1.189	1.303	1.618	1.155	1.045	1.079	0.925	0.971	1.178	0.032
2214	1.239	1.260	1.343	1.289	1.304	1.196	1.647	1.247	1.194	1.841	1.485	1.361	1.444	1.278	1.316	1.209	1.151	1.476	1.239	1.346	1.602	1.126	1.029	1.095	0.889	0.940	1.210	-0.005
2224	1.229	1.256	1.279	1.236	1.274	1.130	1.671	1.277	1.368	1.801	1.618	1.446	1.575	1.337	1.336	1.185	1.174	1.542	1.253	1.321	1.506	1.206	1.055	1.128	0.965	0.995	1.279	-0.067
2234	1.239	1.248	1.306	1.289	1.307	1.153	1.731	1.299	1.365	1.883	1.569	1.435	1.568	1.333	1.321	1.208	1.162	1.541	1.302	1.322	1.586	1.192	1.089	1.116	0.985	1.009	1.222	-0.046

2244	1.371	1.335	1.428	1.366	1.374	1.184	1.845	1.358	1.402	1.998	1.600	1.449	1.569	1.309	1.286	1.207	1.249	1.621	1.287	1.451	1.871	1.367	1.219	1.250	1.103	1.162	1.341	0.117
2254	1.367	1.382	1.433	1.389	1.406	1.184	1.995	1.397	1.490	2.066	1.587	1.470	1.555	1.366	1.331	1.246	1.268	1.640	1.319	1.418	1.914	1.435	1.239	1.289	1.085	1.210	1.346	0.092
2264	1.318	1.359	1.485	1.326	1.347	1.157	1.721	1.359	1.375	1.980	1.557	1.461	1.611	1.327	1.330	1.190	1.264	1.606	1.320	1.460	1.755	1.276	1.281	1.210	1.069	1.059	1.284	0.058
2274	1.344	1.364	1.445	1.334	1.406	1.237	1.771	1.371	1.350	1.980	1.596	1.511	1.675	1.371	1.362	1.220	1.295	1.662	1.337	1.460	1.743	1.348	1.278	1.270	1.138	1.102	1.262	0.065
2285	1.363	1.392	1.438	1.402	1.404	1.216	1.850	1.461	1.418	2.163	1.711	1.543	1.653	1.447	1.504	1.245	1.368	1.686	1.401	1.474	1.842	1.362	1.181	1.212	1.143	1.257	1.365	0.018
2295	1.371	1.426	1.471	1.358	1.382	1.211	1.868	1.422	1.374	2.292	1.695	1.539	1.725	1.459	1.512	1.202	1.341	1.658	1.389	1.486	1.800	1.407	1.237	1.140	1.170	1.440	1.339	-0.036
2305	1.325	1.490	1.511	1.455	1.450	1.210	2.060	1.430	1.468	2.097	1.882	1.631	1.750	1.424	1.474	1.313	1.439	1.635	1.414	1.452	1.755	1.394	1.216	1.415	1.137	1.225	1.443	0.005
2315	1.341	1.497	1.614	1.438	1.451	1.181	1.946	1.540	1.476	2.107	1.882	1.701	1.682	1.382	1.474	1.333	1.453	1.612	1.355	1.453	1.701	1.374	1.178	1.508	1.105	1.147	1.446	0.027
2325	1.412	1.494	1.486	1.407	1.493	1.178	1.968	1.473	1.406	2.073	1.637	1.642	1.709	1.449	1.446	1.246	1.402	1.686	1.314	1.492	2.038	1.408	1.257	1.380	1.100	1.151	1.303	0.146
2335	1.384	1.489	1.466	1.368	1.574	1.222	1.954	1.511	1.377	2.210	1.674	1.729	1.666	1.492	1.472	1.266	1.463	1.723	1.357	1.544	2.094	1.620	1.260	1.517	1.187	1.263	1.313	0.254
2345	1.413	1.672	1.463	1.685	1.587	1.281	2.426	1.272	1.631	2.020	1.911	1.480	1.707	1.537	1.370	1.385	1.289	1.621	1.308	1.444	1.472	1.387	1.352	1.111	1.227	1.415	1.354	-0.310
2355	1.684	1.793	1.593	1.698	1.530	1.334	2.737	1.315	1.606	2.345	2.172	1.461	1.788	1.768	1.425	1.486	1.382	1.554	1.392	1.432	1.424	1.612	1.283	1.145	1.227	1.327	1.247	-0.296
2365	1.718	1.715	2.450	2.170	1.828	1.721	1.718	2.386	1.721	3.913	2.002	2.252	2.325	1.642	2.142	1.481	1.754	1.882	1.632	2.036	1.764	1.611	1.545	1.259	1.237	1.645	1.582	-0.189
2375	2.199	2.240	5.922	2.959	1.957	2.504	1.832	3.440	1.425	5.446	2.105	2.589	2.888	1.806	3.187	1.542	2.067	2.180	1.811	2.265	1.402	1.421	1.455	1.265	1.222	1.427	1.742	-0.272
2385	1.190	#####	5.240	1.608	2.384	1.824	1.271	1.127	1.914	13.802	18.587	2.149	2.066	1.269	1.306	4.789	2.304	3.126	1.382	4.125	1.572	3.408	#####	11.222	1.223	1.003	3.572	0.219
2396	1.068	#####	5.502	2.285	3.554	2.797	1.893	1.607	1.415	-8.651	34.809	3.562	2.272	1.998	1.687	10.341	1.998	4.141	1.824	9.054	2.233	5.498	-4.370	-8.935	1.249	1.112	4.531	-0.025
2406	-2.947	-3.619	-2.789	-3.163	-3.190	-3.228	-2.797	-2.616	-1.959	-1.909	-4.043	-4.352	-5.200	-5.166	-4.543	-3.014	-2.630	-4.671	-4.592	-4.465	-1.855	-2.415	-2.496	-2.453	-2.285	-2.230	-2.603	0.204
2416	-4.010	-4.924	-3.795	-4.303	-4.341	-4.392	-3.806	-3.559	-2.665	-2.598	-5.501	-5.921	-7.075	-7.029	-6.181	-4.101	-3.579	-6.355	-6.249	-6.075	-2.524	-3.286	-3.397	-3.338	-3.109	-3.034	-3.542	0.204
2426	-6.314	-7.753	-5.975	-6.776	-6.835	-6.916	-5.993	-5.604	-4.197	-4.090	-8.663	-9.324	-11.140	#####	-9.733	-6.457	-5.636	#####	-9.839	-9.566	-3.975	-5.174	-5.348	-5.256	-4.896	-4.778	-5.577	0.204
2436	-11.120	#####	#####	#####	#####	#####	#####	-9.869	-7.390	-7.203	#####	#####	#####	#####	#####	-11.371	-9.924	#####	#####	#####	-7.000	-9.112	-9.418	-9.255	-8.622	-8.414	-9.821	0.204
2446	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
2456	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
2466	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####

	266	**268**	**269**	**270**	**271**	**272**	**276**	**277**	**280**	**281**	**282**	**283**	**284**	**286**	**287**	**288**	**292**	**294**	**295**	**296**	**298**	**299**	**300**	**301**	**302**	**304**	**305**
TP (mg/l)	0.062	0.052	0.067	0.088	0.071	0.074	0.056	0.049	0.080	0.126	0.127	0.162	0.064	0.049	0.167	0.123	0.064	0.043	0.141	0.338	0.471	0.248	0.098	0.447	0.260	0.057	0.070

APPENDIX D-3

LOG BANDS RATIO REGRESSIONS

FEBRUARY 24, 2006

	269	271	272	273	274	276	281	282	283	284	286	287	288	291	292	293	296	297	298	299	300	301	r
108.0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
115.3	1.808	1.807	#NUM!	1.618	1.666	1.674	1.328	1.712	1.840	1.697	1.578	1.668	1.873	1.368	#NUM!	1.814	1.807	#NUM!	#NUM!	#NUM!	#NUM!	1.452	#NUM!
122.6	1.784	1.776	#NUM!	1.599	1.821	1.645	1.666	1.667	1.840	1.879	1.785	1.850	1.828	1.705	#NUM!	1.960	1.751	#NUM!	#NUM!	#NUM!	#NUM!	1.442	#NUM!
129.7	1.738	1.742	#NUM!	1.751	1.787	1.801	1.821	1.842	1.814	1.845	1.733	1.816	1.783	#NUM!	1.835	1.946	1.946	#NUM!	#NUM!	1.731	1.422	1.343	#NUM!
136.7	1.705	1.718	1.132	1.724	1.764	1.770	1.782	1.808	1.770	1.810	1.709	1.784	1.757	1.835	1.617	1.920	1.915	1.300	1.312	1.715	1.391	1.724	-0.598
143.6	1.680	1.665	1.494	1.698	1.730	1.747	1.764	1.795	1.747	1.786	1.667	1.754	1.713	1.610	1.768	1.667	1.873	1.276	#NUM!	1.667	1.770	1.691	#NUM!
150.4	1.664	1.650	1.478	1.683	1.714	1.724	1.741	1.765	1.707	1.751	1.650	1.731	1.696	1.790	1.750	1.850	1.843	1.246	1.211	1.867	1.719	1.276	-0.499
157.0	1.631	1.630	1.065	1.659	1.693	1.704	1.716	1.738	1.686	1.734	1.621	1.703	1.655	1.767	1.525	1.835	1.835	1.186	1.204	1.837	1.932	1.645	-0.359
163.6	1.612	1.601	1.433	1.622	1.659	1.669	1.700	1.710	1.670	1.711	1.584	1.676	1.622	1.733	1.706	1.821	1.812	1.581	1.765	1.805	1.897	1.180	-0.219
170.0	1.576	1.572	1.383	1.596	1.631	1.650	1.669	1.684	1.630	1.680	1.552	1.639	1.606	1.710	1.675	1.789	1.773	1.762	1.537	1.775	1.873	1.794	-0.319
176.3	1.563	1.540	1.383	1.584	1.613	1.631	1.645	1.665	1.597	1.650	1.525	1.625	1.589	1.700	1.660	1.771	1.760	1.757	1.727	1.781	1.848	1.588	-0.208
182.5	1.534	1.519	1.568	1.559	1.735	1.604	1.617	1.640	1.592	1.640	1.474	1.610	1.552	1.665	1.630	1.753	1.742	1.728	1.710	1.739	1.821	1.535	-0.093
188.6	1.490	1.781	1.550	1.535	1.570	1.578	1.603	1.635	1.565	1.621	1.459	1.586	1.528	1.645	1.606	1.742	1.726	1.717	1.679	1.729	1.807	1.519	0.010
194.6	1.479	1.756	1.536	1.513	1.692	1.558	1.586	1.590	1.542	1.597	1.421	1.549	1.491	1.626	1.589	1.697	1.687	1.691	1.664	1.696	1.788	1.508	0.030
200.4	1.463	1.735	1.283	1.509	1.790	1.554	1.574	1.576	1.525	1.571	1.413	1.535	1.478	1.607	1.580	1.681	1.676	1.675	1.650	1.691	1.765	1.713	-0.084
206.2	1.613	1.718	1.494	1.475	1.774	1.525	1.540	1.563	1.508	1.561	1.379	1.517	1.640	1.584	1.549	1.660	1.650	1.650	1.631	1.665	1.739	1.471	0.002
211.9	1.423	1.695	1.477	1.451	1.749	1.501	1.523	1.542	1.463	1.527	1.356	1.478	1.623	1.571	1.527	1.639	1.629	1.635	1.386	1.640	1.733	1.422	-0.181
217.5	1.569	1.778	1.447	1.444	1.736	1.491	1.505	1.526	1.463	1.675	1.323	1.470	1.726	1.550	1.510	1.620	1.610	1.611	1.603	1.630	1.711	1.645	0.080
222.9	1.663	1.767	1.435	1.421	1.723	1.475	1.498	1.508	1.446	1.660	1.294	1.622	1.711	1.537	1.477	1.600	1.751	1.596	1.568	1.606	1.682	1.402	-0.100
228.3	1.534	1.745	1.411	1.396	1.695	1.453	1.458	1.486	1.404	1.475	1.275	1.429	1.788	1.504	1.470	1.576	1.576	1.587	1.543	1.587	1.666	1.615	0.103
233.6	1.513	1.736	1.414	1.386	1.686	1.429	1.448	1.470	1.398	1.619	1.240	1.409	1.777	1.508	1.457	1.841	1.717	1.564	1.546	1.574	1.650	1.578	-0.036
238.8	1.619	1.708	1.376	1.367	1.668	1.417	1.442	1.444	1.383	1.720	1.207	1.377	1.755	1.475	1.421	1.700	1.696	1.552	1.526	1.553	1.634	1.573	-0.023
243.9	1.704	1.700	1.365	1.359	1.653	1.556	1.695	1.432	1.352	1.713	1.435	1.371	1.743	1.463	1.416	1.684	1.676	1.525	1.510	1.534	1.618	1.569	-0.119
248.9	1.670	1.678	1.349	1.328	1.639	1.537	1.398	1.423	1.502	1.684	1.404	1.524	1.721	1.446	1.403	1.775	1.660	1.517	1.482	1.509	1.750	1.532	-0.111
253.9	1.487	1.711	1.314	1.531	1.706	1.578	1.583	1.612	1.552	1.602	1.454	1.571	1.697	1.534	1.611	1.708	1.782	1.302	1.280	1.711	1.810	1.522	-0.272
258.7	1.597	1.740	1.258	1.513	1.786	1.560	1.643	1.525	1.535	1.655	1.426	1.469	1.737	1.463	1.421	1.688	1.682	1.530	1.510	1.547	1.713	1.559	-0.111
263.5	1.594	1.736	1.385	1.546	1.763	1.604	1.617	1.601	1.488	1.633	1.488	1.555	1.735	1.585	1.538	1.720	1.716	1.485	1.394	1.609	1.686	1.516	-0.299
268.2	1.617	1.767	1.382	1.507	1.766	1.600	1.594	1.636	1.528	1.661	1.419	1.532	1.676	1.591	1.434	1.737	1.754	1.462	1.401	1.632	1.709	1.539	-0.241
272.8	1.612	1.729	1.306	1.548	1.781	1.589	1.635	1.575	1.522	1.655	1.427	1.587	1.727	1.532	1.492	1.691	1.712	1.469	1.476	1.657	1.735	1.539	-0.202

277.3	1.575	1.749	1.388	1.518	1.756	1.580	1.643	1.605	1.536	1.686	1.460	1.557	1.683	1.542	1.462	1.729	1.710	1.435	1.496	1.594	1.761	1.559	-0.115
281.7	1.588	1.736	1.337	1.499	1.741	1.622	1.615	1.593	1.514	1.678	1.436	1.529	1.714	1.606	1.448	1.727	1.685	1.476	1.441	1.583	1.708	1.476	-0.259
286.1	1.596	1.747	1.344	1.500	1.771	1.596	1.631	1.587	1.520	1.673	1.429	1.505	1.725	1.467	1.503	1.692	1.732	1.480	1.410	1.635	1.721	1.564	-0.225
290.4	1.585	1.752	1.334	1.527	1.747	1.607	1.621	1.549	1.496	1.691	1.454	1.551	1.708	1.565	1.431	1.721	1.731	1.502	1.473	1.578	1.761	1.441	-0.170
294.6	1.584	1.737	1.338	1.531	1.761	1.585	1.610	1.598	1.558	1.659	1.439	1.545	1.675	1.544	1.427	1.763	1.697	1.486	1.434	1.624	1.724	1.543	-0.224
298.7	1.568	1.722	1.326	1.520	1.761	1.569	1.624	1.567	1.502	1.678	1.452	1.559	1.685	1.518	1.451	1.709	1.738	1.421	1.375	1.625	1.764	1.552	-0.210
302.8	1.592	1.718	1.334	1.536	1.742	1.592	1.621	1.555	1.495	1.676	1.436	1.495	1.675	1.525	1.460	1.715	1.702	1.419	1.457	1.614	1.733	1.555	-0.128
306.8	1.540	1.681	1.335	1.551	1.731	1.580	1.617	1.565	1.521	1.685	1.469	1.580	1.681	1.553	1.430	1.725	1.748	1.481	1.480	1.643	1.768	1.574	-0.161
310.7	1.577	1.689	1.293	1.512	1.744	1.596	1.596	1.567	1.465	1.657	1.455	1.573	1.660	1.552	1.432	1.694	1.725	1.426	1.440	1.638	1.741	1.576	-0.199
314.6	1.547	1.663	1.309	1.552	1.725	1.573	1.588	1.565	1.489	1.632	1.465	1.492	1.648	1.523	1.416	1.727	1.727	1.419	1.421	1.655	1.758	1.576	-0.134
318.4	1.546	1.644	1.328	1.542	1.723	1.555	1.578	1.538	1.466	1.655	1.409	1.486	1.637	1.540	1.392	1.680	1.738	1.438	1.438	1.672	1.801	1.601	-0.052
322.1	1.512	1.602	1.312	1.545	1.693	1.546	1.553	1.551	1.462	1.654	1.449	1.483	1.619	1.518	1.352	1.685	1.743	1.397	1.434	1.658	1.789	1.613	-0.041
325.8	1.504	1.573	1.327	1.528	1.693	1.519	1.556	1.548	1.454	1.626	1.435	1.451	1.595	1.491	1.335	1.665	1.749	1.416	1.393	1.671	1.791	1.604	-0.050
329.4	1.503	1.559	1.289	1.543	1.683	1.537	1.518	1.554	1.439	1.642	1.461	1.462	1.570	1.487	1.294	1.653	1.745	1.398	1.412	1.673	1.805	1.639	-0.009
332.9	1.478	1.528	1.302	1.533	1.676	1.510	1.519	1.532	1.412	1.629	1.454	1.431	1.553	1.508	1.300	1.655	1.755	1.390	1.360	1.687	1.790	1.631	-0.047
336.4	1.481	1.493	1.294	1.542	1.670	1.520	1.491	1.536	1.416	1.618	1.443	1.437	1.524	1.482	1.298	1.638	1.763	1.378	1.366	1.697	1.807	1.660	-0.015
339.9	1.462	1.496	1.283	1.527	1.655	1.509	1.496	1.531	1.409	1.623	1.430	1.408	1.513	1.481	1.258	1.640	1.777	1.390	1.368	1.691	1.801	1.651	-0.013
343.2	1.466	1.473	1.280	1.526	1.654	1.504	1.477	1.529	1.419	1.626	1.458	1.405	1.503	1.493	1.251	1.645	1.773	1.378	1.378	1.699	1.807	1.658	-0.008
346.5	1.454	1.464	1.296	1.526	1.645	1.496	1.472	1.525	1.399	1.624	1.436	1.409	1.497	1.485	1.247	1.632	1.775	1.361	1.354	1.695	1.807	1.661	0.002
349.8	1.452	1.457	1.281	1.527	1.645	1.492	1.472	1.515	1.400	1.621	1.441	1.393	1.480	1.477	1.226	1.635	1.780	1.351	1.346	1.698	1.813	1.660	0.005
353.0	1.447	1.443	1.278	1.522	1.643	1.491	1.462	1.515	1.397	1.620	1.449	1.395	1.474	1.472	1.241	1.630	1.781	1.359	1.356	1.695	1.808	1.664	0.001
356.2	1.444	1.438	1.279	1.523	1.645	1.491	1.462	1.520	1.400	1.615	1.444	1.401	1.471	1.478	1.219	1.633	1.785	1.357	1.336	1.698	1.802	1.668	-0.013
359.3	1.442	1.440	1.280	1.523	1.641	1.479	1.456	1.514	1.402	1.619	1.439	1.406	1.470	1.473	1.226	1.627	1.779	1.361	1.345	1.683	1.803	1.666	0.000
362.3	1.440	1.436	1.283	1.519	1.638	1.485	1.455	1.515	1.398	1.618	1.434	1.393	1.456	1.474	1.224	1.630	1.775	1.342	1.343	1.692	1.800	1.666	0.002
365.3	1.435	1.432	1.284	1.513	1.634	1.473	1.450	1.506	1.390	1.619	1.431	1.386	1.459	1.474	1.211	1.625	1.773	1.351	1.342	1.690	1.797	1.654	0.005
368.3	1.430	1.430	1.275	1.513	1.628	1.472	1.449	1.508	1.390	1.618	1.431	1.392	1.458	1.468	1.217	1.624	1.773	1.340	1.333	1.691	1.800	1.655	-0.002
371.2	1.428	1.432	1.271	1.513	1.628	1.469	1.442	1.504	1.389	1.618	1.426	1.396	1.453	1.468	1.223	1.625	1.776	1.344	1.338	1.685	1.800	1.655	0.000
374.1	1.431	1.427	1.270	1.508	1.626	1.468	1.443	1.508	1.393	1.617	1.425	1.390	1.457	1.464	1.217	1.618	1.777	1.349	1.332	1.680	1.799	1.656	-0.004
376.9	1.432	1.430	1.270	1.512	1.628	1.471	1.443	1.507	1.392	1.615	1.423	1.391	1.453	1.464	1.224	1.622	1.778	1.339	1.329	1.685	1.792	1.657	-0.008
379.6	1.431	1.435	1.269	1.505	1.631	1.465	1.441	1.506	1.398	1.617	1.421	1.399	1.457	1.465	1.217	1.624	1.773	1.340	1.336	1.679	1.788	1.648	-0.012

382.4	1.430	1.440	1.266	1.507	1.629	1.463	1.438	1.505	1.397	1.614	1.417	1.401	1.459	1.461	1.220	1.619	1.764	1.343	1.327	1.675	1.790	1.644	-0.012
385.1	1.425	1.443	1.254	1.502	1.627	1.459	1.441	1.502	1.391	1.612	1.415	1.400	1.457	1.457	1.216	1.621	1.759	1.332	1.332	1.675	1.788	1.642	-0.012
387.7	1.422	1.441	1.261	1.504	1.625	1.458	1.437	1.501	1.391	1.613	1.409	1.397	1.459	1.456	1.218	1.616	1.758	1.330	1.330	1.672	1.784	1.641	-0.006
390.3	1.423	1.440	1.259	1.499	1.621	1.456	1.436	1.499	1.394	1.613	1.410	1.401	1.457	1.460	1.218	1.616	1.759	1.328	1.330	1.672	1.790	1.640	-0.008
392.9	1.424	1.441	1.261	1.500	1.623	1.456	1.437	1.504	1.393	1.615	1.410	1.400	1.461	1.460	1.222	1.619	1.765	1.331	1.326	1.670	1.788	1.640	-0.015
395.4	1.425	1.446	1.262	1.496	1.624	1.458	1.438	1.503	1.395	1.616	1.412	1.406	1.462	1.461	1.225	1.621	1.768	1.329	1.327	1.672	1.788	1.641	-0.018
397.9	1.429	1.450	1.261	1.496	1.625	1.458	1.437	1.505	1.397	1.616	1.408	1.406	1.467	1.459	1.231	1.621	1.767	1.332	1.328	1.667	1.786	1.636	-0.022
400.4	1.429	1.454	1.260	1.495	1.625	1.458	1.439	1.504	1.397	1.616	1.407	1.412	1.467	1.460	1.231	1.620	1.764	1.330	1.329	1.665	1.783	1.636	-0.024
402.8	1.429	1.459	1.261	1.494	1.626	1.456	1.443	1.501	1.400	1.616	1.405	1.412	1.472	1.460	1.233	1.622	1.762	1.333	1.329	1.664	1.781	1.635	-0.025
405.2	1.430	1.460	1.259	1.492	1.625	1.456	1.442	1.503	1.400	1.616	1.403	1.416	1.471	1.458	1.239	1.621	1.762	1.331	1.331	1.661	1.779	1.632	-0.029
407.5	1.431	1.463	1.261	1.490	1.624	1.456	1.440	1.504	1.401	1.616	1.401	1.417	1.473	1.458	1.241	1.621	1.758	1.332	1.329	1.657	1.777	1.629	-0.031
409.9	1.433	1.465	1.259	1.489	1.623	1.456	1.439	1.503	1.402	1.616	1.400	1.421	1.476	1.455	1.244	1.622	1.759	1.334	1.330	1.656	1.774	1.627	-0.036
412.2	1.432	1.467	1.260	1.489	1.624	1.454	1.440	1.504	1.403	1.616	1.396	1.422	1.477	1.459	1.246	1.622	1.757	1.333	1.329	1.653	1.773	1.622	-0.038
414.4	1.433	1.468	1.259	1.487	1.624	1.456	1.442	1.504	1.403	1.617	1.396	1.425	1.478	1.459	1.253	1.623	1.756	1.335	1.331	1.651	1.770	1.621	-0.044
416.6	1.435	1.472	1.260	1.486	1.624	1.455	1.443	1.504	1.408	1.617	1.396	1.425	1.479	1.458	1.253	1.624	1.755	1.335	1.332	1.648	1.768	1.618	-0.045
418.8	1.436	1.474	1.260	1.487	1.625	1.453	1.444	1.505	1.408	1.618	1.395	1.429	1.483	1.457	1.260	1.625	1.752	1.335	1.332	1.646	1.765	1.615	-0.050
421.0	1.437	1.475	1.263	1.486	1.625	1.456	1.444	1.505	1.409	1.617	1.394	1.431	1.484	1.459	1.259	1.626	1.750	1.337	1.334	1.643	1.763	1.614	-0.049
423.1	1.439	1.477	1.262	1.484	1.625	1.455	1.445	1.507	1.412	1.618	1.391	1.434	1.486	1.459	1.266	1.628	1.751	1.340	1.333	1.641	1.761	1.611	-0.058
425.3	1.442	1.479	1.264	1.485	1.626	1.453	1.445	1.507	1.413	1.619	1.393	1.436	1.488	1.460	1.268	1.628	1.749	1.340	1.339	1.640	1.758	1.610	-0.057
427.3	1.444	1.483	1.265	1.485	1.627	1.455	1.446	1.509	1.416	1.619	1.391	1.439	1.491	1.461	1.276	1.631	1.750	1.344	1.337	1.638	1.756	1.609	-0.065
429.4	1.446	1.487	1.264	1.485	1.629	1.458	1.445	1.511	1.419	1.622	1.392	1.442	1.492	1.463	1.280	1.632	1.749	1.350	1.340	1.636	1.754	1.606	-0.071
431.4	1.449	1.490	1.265	1.484	1.633	1.456	1.448	1.512	1.420	1.622	1.392	1.446	1.495	1.463	1.285	1.633	1.749	1.351	1.339	1.634	1.751	1.604	-0.078
433.4	1.447	1.494	1.262	1.483	1.632	1.454	1.448	1.512	1.420	1.620	1.388	1.448	1.496	1.461	1.288	1.633	1.741	1.349	1.343	1.631	1.746	1.599	-0.079
435.4	1.448	1.496	1.263	1.483	1.631	1.453	1.449	1.511	1.420	1.621	1.387	1.449	1.498	1.458	1.289	1.632	1.738	1.351	1.343	1.629	1.747	1.597	-0.077
437.4	1.448	1.495	1.263	1.482	1.629	1.452	1.449	1.514	1.421	1.621	1.387	1.450	1.498	1.461	1.293	1.634	1.739	1.350	1.345	1.628	1.745	1.595	-0.082
439.3	1.450	1.497	1.265	1.482	1.630	1.454	1.451	1.515	1.425	1.623	1.387	1.453	1.501	1.462	1.296	1.637	1.740	1.353	1.346	1.627	1.742	1.595	-0.087
441.2	1.455	1.499	1.270	1.482	1.632	1.454	1.450	1.518	1.426	1.625	1.388	1.456	1.502	1.465	1.300	1.640	1.744	1.358	1.347	1.626	1.740	1.593	-0.093
443.1	1.456	1.503	1.271	1.483	1.634	1.456	1.453	1.521	1.430	1.626	1.389	1.462	1.506	1.466	1.308	1.641	1.742	1.362	1.348	1.625	1.737	1.592	-0.102
445.0	1.458	1.506	1.271	1.484	1.635	1.456	1.455	1.521	1.433	1.626	1.389	1.464	1.509	1.467	1.311	1.644	1.739	1.362	1.352	1.625	1.737	1.590	-0.101
446.9	1.461	1.509	1.274	1.485	1.636	1.458	1.457	1.525	1.437	1.628	1.392	1.468	1.512	1.469	1.319	1.647	1.741	1.368	1.354	1.624	1.736	1.590	-0.109

448.7	1.466	1.513	1.277	1.487	1.638	1.460	1.460	1.529	1.440	1.631	1.394	1.474	1.517	1.473	1.327	1.650	1.743	1.372	1.359	1.623	1.735	1.591	-0.114
450.5	1.470	1.518	1.282	1.490	1.641	1.463	1.463	1.534	1.445	1.634	1.398	1.479	1.521	1.477	1.334	1.655	1.744	1.378	1.362	1.624	1.733	1.589	-0.122
452.3	1.474	1.524	1.283	1.492	1.643	1.465	1.466	1.536	1.449	1.636	1.400	1.484	1.527	1.478	1.339	1.657	1.744	1.381	1.368	1.624	1.733	1.590	-0.124
454.1	1.477	1.527	1.287	1.495	1.646	1.467	1.470	1.540	1.454	1.638	1.404	1.489	1.532	1.483	1.347	1.661	1.745	1.388	1.373	1.625	1.733	1.591	-0.129
455.9	1.482	1.532	1.292	1.498	1.648	1.470	1.473	1.544	1.459	1.642	1.407	1.495	1.535	1.486	1.356	1.665	1.746	1.392	1.376	1.625	1.733	1.591	-0.135
457.6	1.486	1.536	1.296	1.500	1.652	1.474	1.477	1.549	1.464	1.645	1.413	1.500	1.542	1.491	1.361	1.670	1.749	1.398	1.381	1.627	1.732	1.593	-0.142
459.4	1.490	1.541	1.298	1.503	1.655	1.476	1.480	1.552	1.469	1.648	1.415	1.506	1.546	1.494	1.367	1.674	1.749	1.404	1.385	1.627	1.732	1.592	-0.148
461.1	1.492	1.545	1.301	1.506	1.657	1.477	1.483	1.555	1.473	1.649	1.417	1.510	1.551	1.496	1.374	1.676	1.749	1.408	1.390	1.628	1.732	1.592	-0.151
462.8	1.497	1.548	1.304	1.507	1.658	1.479	1.486	1.559	1.476	1.653	1.420	1.515	1.555	1.499	1.379	1.680	1.751	1.411	1.394	1.627	1.732	1.593	-0.154
464.5	1.501	1.552	1.307	1.509	1.661	1.482	1.489	1.563	1.480	1.655	1.423	1.520	1.560	1.502	1.386	1.684	1.753	1.417	1.396	1.629	1.730	1.593	-0.164
466.2	1.504	1.555	1.311	1.512	1.663	1.485	1.492	1.566	1.485	1.657	1.426	1.524	1.563	1.505	1.392	1.687	1.755	1.420	1.400	1.629	1.731	1.594	-0.168
467.8	1.508	1.560	1.316	1.515	1.665	1.488	1.495	1.569	1.488	1.660	1.428	1.529	1.567	1.508	1.397	1.691	1.756	1.426	1.405	1.629	1.731	1.595	-0.169
469.5	1.513	1.563	1.320	1.517	1.669	1.490	1.499	1.574	1.493	1.663	1.432	1.534	1.572	1.514	1.404	1.697	1.760	1.432	1.408	1.631	1.731	1.596	-0.179
471.1	1.517	1.568	1.324	1.521	1.672	1.494	1.504	1.579	1.499	1.666	1.436	1.539	1.577	1.517	1.411	1.700	1.762	1.436	1.413	1.632	1.731	1.597	-0.184
472.7	1.522	1.574	1.328	1.523	1.675	1.497	1.506	1.583	1.503	1.670	1.440	1.544	1.582	1.521	1.420	1.704	1.764	1.443	1.417	1.633	1.731	1.598	-0.192
474.3	1.527	1.579	1.333	1.527	1.678	1.501	1.512	1.588	1.508	1.673	1.445	1.550	1.589	1.526	1.426	1.708	1.766	1.448	1.423	1.635	1.731	1.599	-0.197
475.9	1.532	1.584	1.336	1.529	1.682	1.504	1.514	1.592	1.512	1.676	1.449	1.555	1.593	1.530	1.433	1.712	1.767	1.454	1.428	1.637	1.731	1.601	-0.203
477.5	1.535	1.590	1.340	1.533	1.685	1.508	1.518	1.596	1.518	1.679	1.453	1.561	1.598	1.534	1.440	1.717	1.767	1.460	1.432	1.638	1.731	1.601	-0.210
479.1	1.540	1.595	1.344	1.535	1.688	1.510	1.522	1.600	1.523	1.682	1.457	1.565	1.603	1.537	1.447	1.721	1.769	1.466	1.437	1.639	1.731	1.602	-0.217
480.7	1.544	1.599	1.348	1.539	1.691	1.514	1.525	1.604	1.527	1.685	1.462	1.571	1.608	1.542	1.454	1.724	1.770	1.471	1.441	1.641	1.730	1.604	-0.222
482.2	1.547	1.604	1.351	1.541	1.694	1.517	1.529	1.607	1.531	1.688	1.465	1.576	1.613	1.545	1.459	1.728	1.771	1.476	1.446	1.642	1.729	1.604	-0.229
483.8	1.550	1.608	1.355	1.544	1.696	1.518	1.531	1.611	1.535	1.690	1.468	1.580	1.617	1.548	1.465	1.730	1.771	1.480	1.449	1.644	1.729	1.604	-0.232
485.3	1.553	1.612	1.357	1.546	1.698	1.521	1.535	1.614	1.539	1.692	1.471	1.584	1.621	1.551	1.470	1.734	1.772	1.483	1.454	1.645	1.730	1.604	-0.237
486.9	1.557	1.614	1.361	1.549	1.701	1.523	1.538	1.617	1.543	1.694	1.473	1.589	1.625	1.553	1.474	1.737	1.773	1.487	1.457	1.646	1.729	1.606	-0.240
488.4	1.559	1.617	1.363	1.552	1.703	1.525	1.540	1.620	1.546	1.696	1.476	1.592	1.629	1.557	1.478	1.740	1.775	1.491	1.460	1.646	1.730	1.606	-0.245
489.9	1.563	1.620	1.367	1.554	1.706	1.527	1.543	1.623	1.549	1.699	1.478	1.596	1.631	1.561	1.483	1.743	1.779	1.495	1.463	1.647	1.730	1.607	-0.251
491.5	1.565	1.624	1.369	1.555	1.708	1.529	1.545	1.625	1.552	1.700	1.479	1.598	1.633	1.562	1.486	1.746	1.779	1.497	1.465	1.647	1.728	1.607	-0.255
493.0	1.566	1.627	1.370	1.556	1.708	1.529	1.547	1.627	1.552	1.700	1.480	1.600	1.636	1.563	1.489	1.747	1.777	1.500	1.468	1.648	1.727	1.605	-0.257
494.5	1.568	1.628	1.371	1.558	1.709	1.529	1.548	1.629	1.554	1.701	1.481	1.603	1.638	1.563	1.492	1.749	1.777	1.502	1.469	1.648	1.727	1.605	-0.260
496.0	1.571	1.629	1.375	1.559	1.711	1.531	1.551	1.632	1.558	1.704	1.482	1.606	1.640	1.566	1.496	1.752	1.781	1.506	1.471	1.648	1.726	1.606	-0.267

497.4	1.574	1.633	1.378	1.562	1.713	1.533	1.554	1.636	1.561	1.705	1.485	1.609	1.644	1.569	1.500	1.756	1.782	1.508	1.475	1.649	1.725	1.606	-0.271
498.9	1.577	1.637	1.381	1.564	1.715	1.536	1.557	1.639	1.565	1.708	1.487	1.613	1.648	1.572	1.506	1.758	1.783	1.513	1.477	1.650	1.726	1.606	-0.277
500.4	1.582	1.640	1.385	1.567	1.718	1.539	1.561	1.643	1.569	1.711	1.491	1.616	1.651	1.575	1.510	1.763	1.786	1.518	1.483	1.652	1.726	1.608	-0.280
501.9	1.587	1.645	1.390	1.571	1.722	1.542	1.565	1.648	1.574	1.714	1.495	1.621	1.657	1.580	1.517	1.767	1.789	1.522	1.486	1.654	1.726	1.610	-0.286
503.4	1.592	1.651	1.395	1.575	1.726	1.547	1.569	1.653	1.580	1.718	1.500	1.626	1.661	1.585	1.524	1.772	1.791	1.529	1.491	1.657	1.727	1.612	-0.293
504.8	1.597	1.657	1.400	1.578	1.731	1.551	1.575	1.658	1.585	1.723	1.505	1.632	1.667	1.590	1.531	1.776	1.794	1.533	1.497	1.661	1.728	1.614	-0.299
506.3	1.602	1.664	1.405	1.583	1.735	1.556	1.579	1.662	1.590	1.725	1.510	1.637	1.672	1.594	1.538	1.781	1.796	1.540	1.503	1.664	1.728	1.617	-0.305
507.7	1.607	1.670	1.409	1.587	1.739	1.559	1.585	1.668	1.596	1.730	1.516	1.643	1.678	1.598	1.545	1.786	1.798	1.546	1.508	1.667	1.729	1.619	-0.311
509.2	1.613	1.677	1.415	1.593	1.744	1.564	1.590	1.673	1.601	1.734	1.521	1.648	1.685	1.604	1.553	1.791	1.800	1.552	1.514	1.671	1.732	1.622	-0.315
510.7	1.619	1.682	1.421	1.598	1.748	1.569	1.596	1.679	1.608	1.739	1.527	1.655	1.690	1.611	1.560	1.797	1.805	1.559	1.521	1.676	1.734	1.625	-0.320
512.1	1.626	1.688	1.427	1.604	1.753	1.575	1.602	1.686	1.616	1.744	1.534	1.661	1.696	1.617	1.569	1.802	1.808	1.566	1.527	1.680	1.737	1.630	-0.327
513.6	1.632	1.695	1.432	1.610	1.758	1.580	1.607	1.692	1.622	1.749	1.541	1.667	1.702	1.623	1.576	1.808	1.812	1.572	1.535	1.684	1.740	1.633	-0.330
515.0	1.638	1.701	1.439	1.616	1.764	1.586	1.614	1.697	1.630	1.754	1.548	1.672	1.708	1.629	1.584	1.814	1.817	1.579	1.541	1.689	1.742	1.638	-0.335
516.4	1.645	1.707	1.446	1.622	1.770	1.592	1.620	1.705	1.636	1.760	1.554	1.679	1.715	1.635	1.592	1.820	1.821	1.586	1.549	1.695	1.745	1.642	-0.340
517.9	1.652	1.715	1.451	1.629	1.776	1.598	1.627	1.712	1.644	1.766	1.563	1.686	1.722	1.643	1.601	1.826	1.826	1.594	1.556	1.700	1.749	1.647	-0.347
519.3	1.659	1.722	1.459	1.635	1.783	1.605	1.634	1.718	1.651	1.771	1.569	1.693	1.729	1.650	1.610	1.833	1.832	1.602	1.563	1.706	1.752	1.652	-0.353
520.8	1.665	1.729	1.464	1.642	1.788	1.611	1.640	1.724	1.657	1.776	1.576	1.699	1.735	1.656	1.618	1.839	1.835	1.608	1.571	1.711	1.754	1.655	-0.357
522.2	1.671	1.736	1.470	1.647	1.792	1.616	1.646	1.730	1.664	1.782	1.583	1.705	1.740	1.663	1.626	1.844	1.840	1.614	1.577	1.717	1.757	1.661	-0.362
523.6	1.678	1.742	1.476	1.653	1.798	1.622	1.653	1.738	1.672	1.787	1.589	1.711	1.747	1.670	1.634	1.852	1.845	1.622	1.584	1.723	1.761	1.664	-0.370
525.1	1.685	1.748	1.483	1.659	1.803	1.628	1.659	1.745	1.679	1.793	1.596	1.718	1.754	1.676	1.642	1.858	1.851	1.630	1.592	1.728	1.763	1.669	-0.375
526.5	1.691	1.755	1.489	1.665	1.809	1.634	1.666	1.752	1.685	1.799	1.603	1.725	1.760	1.684	1.650	1.865	1.857	1.637	1.599	1.734	1.766	1.673	-0.382
527.9	1.698	1.761	1.495	1.671	1.815	1.640	1.673	1.759	1.693	1.804	1.609	1.730	1.766	1.691	1.658	1.872	1.862	1.645	1.605	1.739	1.769	1.678	-0.388
529.4	1.704	1.769	1.501	1.676	1.820	1.645	1.681	1.766	1.699	1.809	1.616	1.736	1.773	1.697	1.667	1.877	1.866	1.651	1.613	1.745	1.772	1.682	-0.393
530.8	1.710	1.775	1.507	1.683	1.825	1.650	1.688	1.773	1.706	1.814	1.623	1.742	1.781	1.703	1.675	1.883	1.871	1.658	1.620	1.750	1.775	1.686	-0.398
532.2	1.717	1.782	1.513	1.689	1.831	1.656	1.694	1.780	1.713	1.820	1.630	1.749	1.788	1.711	1.683	1.890	1.877	1.666	1.628	1.756	1.777	1.691	-0.405
533.7	1.723	1.788	1.518	1.694	1.836	1.661	1.702	1.786	1.721	1.825	1.636	1.754	1.795	1.717	1.691	1.896	1.881	1.672	1.635	1.761	1.780	1.694	-0.411
535.1	1.729	1.795	1.524	1.700	1.842	1.667	1.709	1.794	1.727	1.830	1.644	1.761	1.801	1.723	1.699	1.903	1.885	1.679	1.642	1.767	1.783	1.699	-0.416
536.6	1.735	1.801	1.529	1.706	1.847	1.672	1.716	1.801	1.734	1.835	1.650	1.767	1.808	1.730	1.707	1.909	1.890	1.687	1.649	1.773	1.786	1.703	-0.423
538.0	1.741	1.808	1.535	1.712	1.853	1.678	1.723	1.807	1.742	1.841	1.658	1.773	1.816	1.737	1.715	1.915	1.894	1.693	1.657	1.778	1.788	1.707	-0.429
539.4	1.747	1.815	1.541	1.718	1.858	1.684	1.730	1.814	1.749	1.846	1.664	1.780	1.823	1.745	1.724	1.922	1.899	1.701	1.664	1.785	1.791	1.711	-0.436

540.9	1.753	1.822	1.546	1.723	1.863	1.689	1.737	1.821	1.756	1.852	1.671	1.785	1.829	1.751	1.732	1.928	1.904	1.707	1.672	1.791	1.794	1.715	-0.442
542.3	1.758	1.829	1.551	1.729	1.868	1.694	1.745	1.827	1.763	1.857	1.679	1.791	1.835	1.758	1.741	1.935	1.909	1.715	1.680	1.798	1.796	1.720	-0.449
543.7	1.765	1.836	1.557	1.734	1.874	1.700	1.751	1.835	1.770	1.863	1.686	1.797	1.842	1.766	1.749	1.941	1.913	1.722	1.687	1.804	1.800	1.724	-0.455
545.2	1.770	1.842	1.562	1.740	1.879	1.705	1.759	1.842	1.777	1.869	1.694	1.804	1.849	1.773	1.757	1.948	1.919	1.728	1.696	1.811	1.802	1.729	-0.461
546.6	1.777	1.849	1.567	1.746	1.883	1.712	1.766	1.849	1.785	1.875	1.701	1.810	1.855	1.781	1.766	1.955	1.924	1.736	1.703	1.817	1.805	1.733	-0.469
548.1	1.783	1.856	1.573	1.751	1.889	1.717	1.773	1.856	1.792	1.881	1.709	1.816	1.862	1.788	1.775	1.961	1.929	1.743	1.711	1.824	1.809	1.738	-0.475
549.5	1.789	1.862	1.577	1.757	1.894	1.724	1.780	1.863	1.800	1.886	1.716	1.822	1.869	1.797	1.783	1.968	1.935	1.751	1.720	1.831	1.812	1.743	-0.482
551.0	1.795	1.869	1.583	1.763	1.899	1.730	1.788	1.870	1.808	1.893	1.724	1.828	1.876	1.805	1.793	1.974	1.941	1.757	1.728	1.838	1.815	1.748	-0.489
552.4	1.802	1.876	1.588	1.768	1.904	1.736	1.795	1.877	1.816	1.899	1.732	1.834	1.883	1.812	1.802	1.981	1.946	1.765	1.736	1.846	1.820	1.753	-0.495
553.9	1.808	1.883	1.594	1.774	1.909	1.742	1.803	1.885	1.824	1.906	1.739	1.840	1.890	1.821	1.811	1.988	1.952	1.773	1.745	1.853	1.823	1.758	-0.501
555.3	1.814	1.890	1.599	1.779	1.915	1.748	1.810	1.891	1.831	1.912	1.747	1.846	1.896	1.829	1.820	1.995	1.958	1.780	1.753	1.861	1.827	1.763	-0.507
556.8	1.820	1.896	1.603	1.784	1.919	1.753	1.817	1.898	1.839	1.918	1.754	1.851	1.902	1.837	1.828	2.001	1.963	1.787	1.761	1.868	1.829	1.768	-0.515
558.2	1.825	1.902	1.607	1.788	1.923	1.758	1.823	1.904	1.845	1.923	1.760	1.856	1.908	1.843	1.836	2.007	1.967	1.793	1.769	1.874	1.832	1.771	-0.519
559.7	1.829	1.908	1.611	1.792	1.927	1.762	1.829	1.909	1.851	1.927	1.766	1.861	1.913	1.850	1.843	2.012	1.971	1.798	1.775	1.880	1.834	1.775	-0.525
561.2	1.834	1.913	1.614	1.795	1.930	1.767	1.835	1.915	1.857	1.931	1.771	1.864	1.918	1.855	1.850	2.017	1.975	1.804	1.782	1.885	1.836	1.778	-0.531
562.6	1.837	1.918	1.616	1.798	1.933	1.770	1.840	1.919	1.862	1.935	1.776	1.868	1.922	1.860	1.856	2.022	1.978	1.808	1.787	1.890	1.838	1.780	-0.535
564.1	1.840	1.921	1.618	1.799	1.934	1.773	1.844	1.923	1.866	1.938	1.780	1.870	1.926	1.864	1.861	2.025	1.980	1.812	1.792	1.894	1.837	1.782	-0.540
565.6	1.842	1.924	1.619	1.801	1.936	1.775	1.847	1.926	1.869	1.939	1.782	1.872	1.928	1.868	1.866	2.028	1.982	1.815	1.796	1.897	1.838	1.782	-0.543
567.0	1.843	1.928	1.620	1.801	1.937	1.775	1.850	1.927	1.872	1.941	1.784	1.872	1.931	1.870	1.868	2.029	1.982	1.817	1.799	1.900	1.837	1.783	-0.545
568.5	1.843	1.930	1.619	1.801	1.938	1.776	1.851	1.928	1.873	1.942	1.784	1.873	1.932	1.871	1.871	2.031	1.982	1.818	1.801	1.902	1.836	1.782	-0.547
570.0	1.843	1.932	1.618	1.801	1.938	1.775	1.852	1.929	1.874	1.941	1.785	1.872	1.933	1.872	1.872	2.031	1.982	1.819	1.803	1.902	1.835	1.781	-0.547
571.5	1.842	1.932	1.617	1.799	1.937	1.773	1.852	1.929	1.875	1.941	1.784	1.871	1.933	1.871	1.872	2.031	1.982	1.818	1.803	1.903	1.833	1.779	-0.548
573.0	1.841	1.933	1.614	1.797	1.936	1.772	1.852	1.929	1.874	1.939	1.782	1.869	1.932	1.870	1.871	2.030	1.980	1.817	1.803	1.902	1.831	1.776	-0.549
574.4	1.839	1.933	1.611	1.795	1.934	1.770	1.850	1.927	1.872	1.937	1.780	1.866	1.931	1.867	1.869	2.029	1.978	1.816	1.802	1.901	1.828	1.773	-0.548
575.9	1.836	1.931	1.608	1.791	1.931	1.766	1.848	1.924	1.870	1.935	1.777	1.863	1.929	1.865	1.867	2.026	1.976	1.813	1.801	1.899	1.824	1.770	-0.547
577.4	1.832	1.929	1.603	1.787	1.928	1.763	1.845	1.921	1.866	1.932	1.773	1.860	1.926	1.862	1.864	2.024	1.973	1.810	1.797	1.896	1.821	1.766	-0.546
578.9	1.828	1.926	1.599	1.783	1.923	1.759	1.841	1.918	1.863	1.928	1.769	1.855	1.923	1.857	1.861	2.020	1.969	1.805	1.794	1.892	1.817	1.761	-0.545
580.4	1.824	1.923	1.594	1.778	1.920	1.754	1.836	1.913	1.859	1.925	1.765	1.851	1.920	1.853	1.856	2.016	1.965	1.801	1.789	1.888	1.813	1.756	-0.546
581.9	1.819	1.919	1.588	1.772	1.915	1.750	1.831	1.908	1.854	1.920	1.760	1.846	1.916	1.848	1.852	2.011	1.960	1.797	1.785	1.883	1.807	1.751	-0.546
583.4	1.814	1.914	1.582	1.766	1.909	1.743	1.826	1.903	1.849	1.915	1.755	1.841	1.912	1.844	1.847	2.006	1.954	1.791	1.780	1.877	1.800	1.744	-0.547

584.9	1.807	1.909	1.575	1.759	1.904	1.738	1.819	1.896	1.843	1.910	1.749	1.834	1.908	1.837	1.842	2.000	1.947	1.786	1.774	1.870	1.793	1.737	-0.548
586.4	1.800	1.904	1.567	1.751	1.897	1.731	1.813	1.889	1.837	1.904	1.744	1.828	1.903	1.830	1.835	1.994	1.939	1.778	1.768	1.864	1.787	1.729	-0.547
588.0	1.794	1.898	1.558	1.744	1.891	1.725	1.806	1.882	1.832	1.899	1.738	1.821	1.898	1.824	1.829	1.987	1.932	1.771	1.762	1.857	1.781	1.722	-0.547
589.5	1.787	1.892	1.550	1.736	1.884	1.718	1.798	1.875	1.825	1.893	1.731	1.813	1.892	1.816	1.821	1.979	1.925	1.763	1.753	1.849	1.774	1.713	-0.548
591.0	1.778	1.883	1.538	1.726	1.877	1.709	1.789	1.865	1.817	1.886	1.723	1.804	1.885	1.807	1.811	1.970	1.917	1.753	1.743	1.839	1.766	1.703	-0.548
592.5	1.769	1.874	1.526	1.715	1.868	1.699	1.778	1.854	1.807	1.878	1.713	1.795	1.878	1.797	1.800	1.959	1.907	1.742	1.731	1.827	1.757	1.693	-0.547
594.0	1.758	1.863	1.513	1.703	1.859	1.689	1.766	1.843	1.797	1.870	1.704	1.784	1.868	1.785	1.788	1.948	1.897	1.730	1.718	1.815	1.748	1.682	-0.546
595.6	1.749	1.853	1.500	1.691	1.849	1.679	1.755	1.831	1.787	1.862	1.692	1.773	1.860	1.774	1.776	1.937	1.888	1.718	1.706	1.803	1.739	1.670	-0.545
597.1	1.740	1.844	1.488	1.681	1.841	1.670	1.746	1.821	1.777	1.855	1.683	1.764	1.852	1.763	1.765	1.927	1.880	1.707	1.694	1.792	1.731	1.659	-0.544
598.6	1.732	1.836	1.479	1.672	1.834	1.662	1.739	1.814	1.769	1.849	1.674	1.756	1.845	1.754	1.756	1.920	1.873	1.699	1.685	1.782	1.724	1.651	-0.543
600.2	1.727	1.830	1.472	1.665	1.828	1.656	1.733	1.808	1.763	1.843	1.667	1.750	1.840	1.748	1.748	1.915	1.868	1.692	1.677	1.775	1.718	1.644	-0.542
601.7	1.722	1.825	1.466	1.660	1.825	1.651	1.729	1.804	1.758	1.839	1.661	1.745	1.835	1.742	1.743	1.911	1.864	1.685	1.671	1.768	1.714	1.638	-0.541
603.2	1.718	1.821	1.461	1.655	1.821	1.645	1.725	1.800	1.752	1.834	1.654	1.740	1.832	1.736	1.738	1.907	1.860	1.680	1.664	1.763	1.709	1.632	-0.540
604.8	1.713	1.816	1.456	1.651	1.817	1.640	1.722	1.797	1.748	1.830	1.647	1.735	1.828	1.731	1.732	1.903	1.857	1.675	1.659	1.756	1.704	1.627	-0.538
606.3	1.710	1.812	1.450	1.646	1.815	1.634	1.719	1.794	1.743	1.826	1.642	1.731	1.825	1.725	1.726	1.899	1.853	1.669	1.654	1.751	1.701	1.622	-0.535
607.9	1.706	1.808	1.445	1.642	1.811	1.629	1.716	1.790	1.737	1.822	1.636	1.727	1.822	1.719	1.721	1.895	1.849	1.665	1.648	1.746	1.696	1.617	-0.534
609.4	1.702	1.805	1.442	1.637	1.808	1.624	1.713	1.786	1.733	1.818	1.629	1.723	1.818	1.714	1.716	1.892	1.845	1.659	1.643	1.740	1.692	1.611	-0.532
611.0	1.698	1.801	1.437	1.633	1.805	1.619	1.710	1.783	1.728	1.814	1.624	1.719	1.815	1.709	1.712	1.888	1.842	1.655	1.636	1.734	1.687	1.606	-0.533
612.6	1.695	1.798	1.432	1.629	1.802	1.615	1.708	1.779	1.724	1.810	1.619	1.716	1.812	1.704	1.707	1.885	1.839	1.649	1.632	1.729	1.684	1.602	-0.530
614.1	1.692	1.794	1.429	1.625	1.799	1.612	1.705	1.776	1.720	1.808	1.615	1.712	1.810	1.699	1.703	1.882	1.835	1.646	1.628	1.725	1.680	1.598	-0.530
615.7	1.690	1.791	1.426	1.622	1.796	1.609	1.703	1.774	1.717	1.805	1.610	1.709	1.808	1.695	1.700	1.879	1.832	1.642	1.623	1.721	1.677	1.594	-0.530
617.3	1.687	1.789	1.423	1.619	1.794	1.606	1.701	1.771	1.714	1.803	1.607	1.707	1.806	1.692	1.697	1.877	1.830	1.638	1.620	1.717	1.675	1.591	-0.528
618.8	1.685	1.786	1.420	1.616	1.793	1.602	1.698	1.769	1.711	1.801	1.605	1.705	1.804	1.688	1.694	1.875	1.826	1.636	1.617	1.715	1.672	1.588	-0.529
620.4	1.682	1.784	1.417	1.613	1.791	1.599	1.697	1.767	1.708	1.799	1.602	1.703	1.803	1.685	1.691	1.872	1.824	1.633	1.614	1.712	1.669	1.584	-0.528
622.0	1.680	1.783	1.415	1.611	1.789	1.597	1.695	1.765	1.706	1.796	1.599	1.701	1.801	1.682	1.689	1.871	1.821	1.631	1.612	1.708	1.666	1.580	-0.528
623.6	1.679	1.781	1.413	1.609	1.788	1.594	1.694	1.764	1.704	1.795	1.597	1.700	1.800	1.680	1.687	1.868	1.818	1.628	1.610	1.706	1.663	1.579	-0.528
625.1	1.678	1.781	1.411	1.607	1.787	1.593	1.693	1.762	1.703	1.794	1.595	1.699	1.799	1.677	1.685	1.868	1.817	1.627	1.608	1.703	1.663	1.577	-0.527
626.7	1.677	1.781	1.409	1.606	1.787	1.592	1.693	1.761	1.702	1.793	1.593	1.698	1.799	1.676	1.683	1.867	1.816	1.626	1.607	1.703	1.661	1.575	-0.527
628.3	1.676	1.780	1.408	1.606	1.787	1.592	1.694	1.761	1.701	1.793	1.593	1.697	1.798	1.674	1.683	1.866	1.816	1.625	1.606	1.702	1.661	1.575	-0.526
629.9	1.676	1.781	1.408	1.605	1.786	1.590	1.694	1.761	1.702	1.792	1.592	1.698	1.799	1.675	1.682	1.866	1.815	1.625	1.606	1.702	1.660	1.575	-0.525

631.5	1.677	1.781	1.408	1.606	1.786	1.592	1.694	1.762	1.702	1.793	1.592	1.699	1.799	1.675	1.683	1.866	1.815	1.626	1.607	1.703	1.661	1.576	-0.526
633.1	1.678	1.781	1.408	1.606	1.785	1.593	1.696	1.762	1.704	1.794	1.594	1.701	1.801	1.676	1.685	1.867	1.816	1.627	1.609	1.704	1.662	1.578	-0.528
634.7	1.678	1.782	1.411	1.608	1.785	1.594	1.697	1.763	1.706	1.793	1.596	1.702	1.802	1.677	1.687	1.868	1.816	1.630	1.611	1.706	1.663	1.578	-0.529
636.3	1.679	1.784	1.411	1.609	1.786	1.596	1.699	1.764	1.707	1.793	1.598	1.704	1.804	1.678	1.689	1.868	1.816	1.631	1.614	1.707	1.664	1.580	-0.529
637.9	1.679	1.786	1.412	1.609	1.787	1.597	1.699	1.764	1.708	1.795	1.601	1.706	1.805	1.680	1.690	1.868	1.816	1.634	1.616	1.709	1.663	1.581	-0.531
639.5	1.679	1.786	1.412	1.609	1.787	1.598	1.699	1.764	1.709	1.796	1.603	1.706	1.806	1.681	1.690	1.868	1.815	1.634	1.617	1.711	1.664	1.582	-0.533
641.1	1.678	1.786	1.412	1.608	1.787	1.597	1.698	1.763	1.708	1.794	1.603	1.707	1.805	1.680	1.690	1.867	1.813	1.635	1.617	1.711	1.660	1.581	-0.537
642.7	1.675	1.786	1.410	1.606	1.786	1.594	1.696	1.760	1.705	1.793	1.601	1.706	1.804	1.678	1.688	1.866	1.810	1.633	1.616	1.709	1.658	1.579	-0.534
644.3	1.672	1.783	1.405	1.602	1.784	1.591	1.692	1.755	1.702	1.790	1.597	1.704	1.800	1.673	1.682	1.862	1.806	1.631	1.611	1.705	1.655	1.575	-0.533
645.9	1.667	1.780	1.400	1.597	1.780	1.585	1.687	1.750	1.695	1.786	1.590	1.700	1.795	1.666	1.676	1.857	1.802	1.624	1.604	1.700	1.652	1.571	-0.530
647.5	1.660	1.774	1.391	1.589	1.775	1.578	1.679	1.743	1.686	1.780	1.580	1.693	1.787	1.656	1.665	1.850	1.795	1.617	1.595	1.690	1.646	1.564	-0.526
649.1	1.652	1.765	1.380	1.579	1.768	1.569	1.668	1.734	1.676	1.772	1.568	1.685	1.778	1.645	1.653	1.840	1.788	1.607	1.582	1.678	1.639	1.555	-0.523
650.7	1.641	1.753	1.368	1.566	1.759	1.558	1.655	1.721	1.661	1.760	1.552	1.674	1.766	1.629	1.637	1.829	1.777	1.591	1.564	1.662	1.630	1.542	-0.517
652.3	1.629	1.739	1.351	1.552	1.748	1.543	1.641	1.706	1.643	1.748	1.535	1.661	1.752	1.611	1.618	1.814	1.763	1.575	1.544	1.643	1.620	1.528	-0.509
653.9	1.616	1.724	1.336	1.536	1.735	1.529	1.625	1.692	1.626	1.737	1.515	1.648	1.738	1.593	1.599	1.801	1.751	1.557	1.524	1.624	1.609	1.514	-0.503
655.6	1.605	1.709	1.322	1.522	1.724	1.516	1.609	1.677	1.610	1.727	1.499	1.635	1.724	1.577	1.581	1.788	1.740	1.540	1.507	1.605	1.601	1.502	-0.494
657.2	1.595	1.696	1.310	1.509	1.714	1.505	1.594	1.665	1.595	1.717	1.482	1.624	1.711	1.559	1.564	1.775	1.729	1.526	1.487	1.589	1.593	1.491	-0.488
658.8	1.586	1.684	1.300	1.498	1.706	1.497	1.581	1.652	1.581	1.709	1.469	1.616	1.699	1.545	1.550	1.764	1.719	1.513	1.473	1.574	1.588	1.482	-0.481
660.4	1.579	1.674	1.294	1.489	1.698	1.489	1.569	1.641	1.571	1.703	1.459	1.610	1.690	1.535	1.536	1.756	1.709	1.502	1.460	1.562	1.584	1.475	-0.474
662.0	1.573	1.667	1.289	1.482	1.693	1.486	1.559	1.633	1.564	1.699	1.455	1.606	1.683	1.526	1.530	1.749	1.702	1.495	1.452	1.553	1.583	1.473	-0.469
663.7	1.571	1.663	1.288	1.479	1.690	1.485	1.553	1.627	1.563	1.698	1.456	1.607	1.681	1.524	1.526	1.745	1.696	1.491	1.447	1.549	1.584	1.474	-0.468
665.3	1.572	1.662	1.294	1.480	1.690	1.490	1.549	1.624	1.566	1.700	1.462	1.609	1.682	1.523	1.526	1.744	1.694	1.494	1.448	1.548	1.589	1.478	-0.466
666.9	1.577	1.665	1.299	1.482	1.691	1.497	1.548	1.623	1.570	1.703	1.471	1.615	1.687	1.527	1.529	1.747	1.693	1.498	1.450	1.551	1.595	1.485	-0.466
668.5	1.582	1.670	1.306	1.487	1.695	1.506	1.549	1.624	1.575	1.707	1.483	1.623	1.691	1.534	1.535	1.749	1.693	1.505	1.457	1.554	1.603	1.492	-0.466
670.2	1.589	1.675	1.315	1.492	1.698	1.516	1.551	1.626	1.582	1.714	1.493	1.631	1.697	1.541	1.543	1.752	1.695	1.512	1.465	1.560	1.611	1.503	-0.467
671.8	1.595	1.681	1.324	1.500	1.702	1.526	1.554	1.629	1.589	1.720	1.506	1.639	1.705	1.550	1.551	1.757	1.698	1.520	1.472	1.567	1.620	1.512	-0.466
673.4	1.601	1.688	1.332	1.506	1.705	1.536	1.557	1.633	1.598	1.727	1.518	1.647	1.711	1.559	1.561	1.763	1.700	1.530	1.481	1.575	1.628	1.522	-0.469
675.1	1.607	1.695	1.340	1.514	1.710	1.544	1.562	1.637	1.605	1.733	1.530	1.655	1.719	1.568	1.570	1.768	1.704	1.539	1.491	1.583	1.636	1.530	-0.469
676.7	1.614	1.702	1.348	1.521	1.715	1.553	1.567	1.642	1.614	1.741	1.541	1.663	1.726	1.576	1.578	1.774	1.707	1.548	1.501	1.591	1.642	1.538	-0.472
678.3	1.620	1.709	1.356	1.528	1.719	1.563	1.572	1.647	1.623	1.748	1.553	1.670	1.733	1.587	1.589	1.780	1.713	1.556	1.509	1.601	1.649	1.547	-0.479

680.0	1.627	1.717	1.363	1.536	1.725	1.571	1.577	1.653	1.633	1.756	1.566	1.678	1.741	1.598	1.600	1.787	1.717	1.568	1.520	1.610	1.656	1.556	-0.483
681.6	1.635	1.726	1.373	1.544	1.731	1.584	1.585	1.661	1.644	1.764	1.580	1.688	1.749	1.611	1.615	1.796	1.724	1.581	1.533	1.624	1.664	1.566	-0.492
683.2	1.640	1.735	1.377	1.552	1.737	1.593	1.590	1.665	1.653	1.771	1.594	1.694	1.756	1.624	1.627	1.803	1.726	1.592	1.548	1.635	1.668	1.576	-0.498
684.9	1.640	1.739	1.374	1.552	1.736	1.594	1.592	1.664	1.657	1.773	1.600	1.693	1.758	1.630	1.633	1.802	1.722	1.594	1.552	1.640	1.666	1.574	-0.507
686.5	1.637	1.740	1.366	1.549	1.734	1.593	1.590	1.663	1.657	1.772	1.601	1.688	1.755	1.631	1.635	1.799	1.720	1.590	1.554	1.641	1.659	1.569	-0.513
688.1	1.633	1.739	1.360	1.546	1.732	1.589	1.586	1.659	1.657	1.772	1.600	1.682	1.752	1.632	1.637	1.795	1.716	1.589	1.554	1.642	1.651	1.562	-0.521
689.8	1.629	1.736	1.351	1.542	1.729	1.585	1.583	1.655	1.656	1.770	1.600	1.676	1.748	1.633	1.638	1.791	1.711	1.586	1.554	1.643	1.645	1.556	-0.529
691.4	1.623	1.734	1.342	1.536	1.725	1.579	1.578	1.649	1.653	1.768	1.597	1.669	1.744	1.630	1.635	1.785	1.705	1.581	1.550	1.641	1.635	1.548	-0.533
693.0	1.617	1.728	1.330	1.529	1.720	1.575	1.570	1.642	1.649	1.765	1.593	1.661	1.737	1.626	1.631	1.778	1.698	1.574	1.545	1.636	1.627	1.540	-0.536
694.7	1.610	1.722	1.321	1.520	1.714	1.568	1.562	1.634	1.644	1.761	1.588	1.653	1.731	1.622	1.626	1.770	1.691	1.567	1.537	1.630	1.619	1.531	-0.541
696.3	1.601	1.714	1.309	1.510	1.707	1.558	1.552	1.624	1.636	1.754	1.580	1.644	1.722	1.612	1.617	1.761	1.682	1.556	1.530	1.621	1.608	1.521	-0.540
697.9	1.592	1.705	1.294	1.498	1.699	1.549	1.541	1.613	1.627	1.747	1.570	1.632	1.713	1.603	1.606	1.749	1.669	1.545	1.516	1.609	1.597	1.507	-0.541
699.6	1.581	1.696	1.280	1.484	1.690	1.537	1.527	1.601	1.615	1.739	1.558	1.621	1.703	1.590	1.595	1.737	1.658	1.530	1.503	1.596	1.587	1.493	-0.537
701.2	1.569	1.684	1.260	1.468	1.680	1.524	1.516	1.587	1.603	1.730	1.544	1.608	1.692	1.577	1.581	1.725	1.646	1.516	1.487	1.582	1.575	1.479	-0.539
702.8	1.558	1.673	1.245	1.454	1.670	1.510	1.502	1.575	1.592	1.721	1.529	1.596	1.680	1.563	1.568	1.712	1.633	1.500	1.472	1.567	1.564	1.465	-0.535
704.5	1.545	1.660	1.227	1.436	1.660	1.497	1.488	1.561	1.578	1.711	1.512	1.583	1.669	1.547	1.551	1.697	1.620	1.483	1.453	1.551	1.549	1.448	-0.537
706.1	1.532	1.646	1.208	1.418	1.649	1.482	1.472	1.547	1.564	1.700	1.493	1.567	1.656	1.530	1.533	1.682	1.605	1.466	1.433	1.531	1.536	1.430	-0.534
707.7	1.517	1.632	1.187	1.398	1.636	1.465	1.457	1.531	1.548	1.688	1.473	1.553	1.642	1.511	1.515	1.666	1.590	1.445	1.415	1.514	1.524	1.412	-0.528
709.3	1.502	1.616	1.164	1.377	1.623	1.448	1.441	1.512	1.531	1.676	1.453	1.537	1.627	1.492	1.496	1.650	1.573	1.426	1.393	1.492	1.508	1.394	-0.527
711.0	1.486	1.600	1.142	1.354	1.610	1.432	1.423	1.495	1.513	1.662	1.434	1.521	1.612	1.474	1.478	1.635	1.556	1.408	1.373	1.473	1.496	1.374	-0.526
712.6	1.470	1.586	1.126	1.332	1.596	1.414	1.407	1.479	1.497	1.649	1.411	1.508	1.598	1.456	1.462	1.620	1.540	1.390	1.352	1.454	1.481	1.358	-0.525
714.2	1.453	1.574	1.106	1.308	1.581	1.399	1.388	1.459	1.479	1.634	1.392	1.495	1.584	1.439	1.446	1.605	1.520	1.375	1.336	1.434	1.470	1.343	-0.520
715.9	1.433	1.562	1.086	1.285	1.569	1.380	1.371	1.439	1.455	1.616	1.371	1.481	1.571	1.417	1.425	1.587	1.496	1.355	1.316	1.413	1.456	1.322	-0.512
717.5	1.413	1.551	1.056	1.259	1.554	1.359	1.354	1.417	1.434	1.600	1.346	1.461	1.553	1.391	1.405	1.564	1.468	1.324	1.289	1.392	1.440	1.299	-0.502
719.1	1.401	1.534	1.031	1.238	1.541	1.343	1.339	1.399	1.419	1.592	1.323	1.443	1.536	1.367	1.384	1.544	1.450	1.303	1.264	1.370	1.424	1.282	-0.501
720.7	1.391	1.522	1.013	1.218	1.534	1.328	1.321	1.386	1.406	1.582	1.302	1.428	1.521	1.353	1.366	1.529	1.437	1.284	1.248	1.354	1.418	1.267	-0.491
722.4	1.375	1.510	0.991	1.200	1.523	1.315	1.307	1.367	1.389	1.571	1.280	1.414	1.507	1.334	1.350	1.514	1.417	1.267	1.227	1.338	1.403	1.250	-0.490
724.0	1.361	1.499	0.967	1.176	1.513	1.296	1.292	1.347	1.372	1.560	1.258	1.396	1.493	1.313	1.332	1.498	1.393	1.246	1.208	1.323	1.394	1.232	-0.481
725.6	1.346	1.488	0.951	1.153	1.502	1.282	1.277	1.329	1.354	1.548	1.232	1.381	1.475	1.290	1.309	1.476	1.375	1.218	1.189	1.302	1.383	1.209	-0.468
727.2	1.333	1.475	0.921	1.127	1.491	1.263	1.259	1.308	1.336	1.537	1.208	1.364	1.456	1.269	1.290	1.456	1.352	1.193	1.159	1.285	1.373	1.197	-0.464

728.9	1.319	1.464	0.892	1.106	1.482	1.244	1.242	1.287	1.320	1.528	1.176	1.345	1.438	1.244	1.263	1.432	1.326	1.165	1.133	1.265	1.361	1.169	-0.451
730.5	1.309	1.450	0.864	1.083	1.475	1.231	1.228	1.270	1.306	1.521	1.147	1.323	1.416	1.219	1.241	1.409	1.309	1.138	1.108	1.250	1.350	1.146	-0.445
732.1	1.303	1.440	0.852	1.066	1.469	1.217	1.217	1.254	1.296	1.520	1.120	1.305	1.402	1.200	1.221	1.394	1.293	1.106	1.089	1.234	1.345	1.133	-0.427
733.7	1.297	1.431	0.830	1.053	1.467	1.207	1.206	1.242	1.290	1.514	1.099	1.293	1.389	1.186	1.207	1.380	1.282	1.091	1.066	1.221	1.334	1.118	-0.428
735.3	1.293	1.427	0.821	1.043	1.463	1.203	1.200	1.232	1.285	1.511	1.087	1.284	1.380	1.171	1.194	1.370	1.272	1.078	1.060	1.216	1.331	1.113	-0.419
736.9	1.291	1.424	0.809	1.033	1.462	1.195	1.197	1.227	1.280	1.510	1.074	1.277	1.374	1.165	1.186	1.365	1.266	1.067	1.047	1.214	1.330	1.102	-0.419
738.5	1.291	1.423	0.806	1.030	1.462	1.195	1.196	1.227	1.281	1.510	1.063	1.272	1.372	1.161	1.180	1.359	1.264	1.056	1.040	1.210	1.327	1.093	-0.414
740.2	1.291	1.425	0.803	1.024	1.462	1.193	1.194	1.221	1.280	1.513	1.059	1.269	1.368	1.155	1.175	1.354	1.259	1.052	1.037	1.209	1.328	1.095	-0.409
741.8	1.292	1.422	0.794	1.022	1.463	1.194	1.196	1.221	1.279	1.513	1.050	1.268	1.368	1.153	1.173	1.355	1.262	1.044	1.030	1.205	1.327	1.091	-0.410
743.4	1.290	1.423	0.789	1.022	1.464	1.193	1.196	1.219	1.282	1.513	1.048	1.265	1.368	1.149	1.167	1.352	1.259	1.042	1.029	1.205	1.330	1.089	-0.405
745.0	1.291	1.423	0.782	1.019	1.465	1.195	1.198	1.218	1.280	1.512	1.048	1.262	1.366	1.147	1.167	1.351	1.257	1.039	1.023	1.205	1.327	1.088	-0.410
746.6	1.291	1.425	0.783	1.016	1.464	1.197	1.195	1.218	1.279	1.513	1.039	1.260	1.365	1.146	1.165	1.350	1.259	1.035	1.018	1.204	1.329	1.084	-0.407
748.2	1.294	1.427	0.787	1.012	1.464	1.194	1.199	1.213	1.280	1.512	1.037	1.260	1.365	1.142	1.162	1.351	1.253	1.034	1.014	1.204	1.327	1.079	-0.408
749.8	1.289	1.427	0.778	1.008	1.465	1.193	1.195	1.214	1.280	1.512	1.037	1.259	1.365	1.141	1.163	1.349	1.254	1.027	1.013	1.203	1.327	1.078	-0.408
751.4	1.290	1.429	0.782	1.008	1.465	1.191	1.198	1.213	1.279	1.513	1.027	1.257	1.364	1.137	1.159	1.347	1.251	1.031	1.016	1.202	1.325	1.077	-0.403
753.0	1.291	1.431	0.777	1.007	1.465	1.192	1.197	1.214	1.276	1.511	1.029	1.256	1.364	1.136	1.160	1.346	1.246	1.019	1.012	1.198	1.327	1.068	-0.401
754.6	1.290	1.429	0.769	1.007	1.466	1.191	1.195	1.210	1.281	1.511	1.024	1.252	1.363	1.136	1.159	1.346	1.242	1.026	1.008	1.196	1.328	1.071	-0.401
756.2	1.293	1.427	0.780	1.005	1.465	1.194	1.192	1.214	1.280	1.513	1.023	1.254	1.362	1.136	1.162	1.350	1.251	1.030	1.014	1.200	1.324	1.070	-0.406
757.8	1.299	1.425	0.796	1.013	1.469	1.206	1.195	1.222	1.291	1.516	1.028	1.263	1.364	1.150	1.170	1.364	1.267	1.042	1.021	1.203	1.332	1.083	-0.412
759.4	1.304	1.437	0.809	1.021	1.476	1.212	1.204	1.227	1.297	1.510	1.050	1.275	1.379	1.157	1.182	1.378	1.269	1.060	1.043	1.212	1.334	1.086	-0.415
760.9	1.289	1.446	0.825	1.011	1.472	1.210	1.217	1.212	1.281	1.500	1.068	1.285	1.399	1.164	1.206	1.379	1.248	1.073	1.051	1.212	1.344	1.100	-0.414
762.5	1.282	1.456	0.788	0.998	1.467	1.200	1.216	1.211	1.261	1.489	1.064	1.271	1.396	1.146	1.184	1.361	1.218	1.061	1.039	1.198	1.337	1.088	-0.402
764.1	1.277	1.454	0.779	0.998	1.463	1.194	1.210	1.197	1.256	1.489	1.043	1.262	1.386	1.133	1.180	1.352	1.208	1.043	1.030	1.193	1.331	1.062	-0.392
765.7	1.278	1.449	0.767	0.992	1.461	1.188	1.204	1.203	1.254	1.492	1.018	1.254	1.375	1.125	1.163	1.340	1.211	1.022	1.014	1.189	1.325	1.056	-0.389
767.3	1.283	1.444	0.759	0.990	1.463	1.186	1.202	1.204	1.262	1.496	1.018	1.248	1.369	1.116	1.153	1.337	1.217	1.011	1.002	1.187	1.325	1.051	-0.391
768.9	1.283	1.441	0.760	0.989	1.464	1.184	1.201	1.206	1.266	1.502	1.011	1.247	1.367	1.124	1.154	1.338	1.220	1.005	1.000	1.189	1.322	1.053	-0.394
770.4	1.288	1.442	0.758	0.994	1.467	1.187	1.197	1.205	1.270	1.501	1.010	1.244	1.364	1.119	1.152	1.341	1.226	1.008	1.003	1.191	1.328	1.047	-0.389
772.0	1.287	1.442	0.759	0.995	1.468	1.188	1.201	1.204	1.273	1.503	1.007	1.243	1.366	1.122	1.153	1.341	1.229	1.010	0.996	1.192	1.320	1.049	-0.397
773.6	1.288	1.442	0.755	0.988	1.467	1.189	1.205	1.208	1.274	1.506	1.006	1.247	1.366	1.123	1.153	1.341	1.231	1.004	1.001	1.189	1.323	1.048	-0.396
775.1	1.291	1.443	0.757	0.991	1.467	1.190	1.200	1.207	1.275	1.505	1.010	1.249	1.367	1.121	1.150	1.345	1.228	1.007	1.000	1.193	1.323	1.049	-0.396

776.7	1.291	1.443	0.763	0.997	1.471	1.189	1.205	1.212	1.276	1.506	1.009	1.248	1.371	1.123	1.154	1.346	1.227	1.011	1.002	1.191	1.324	1.048	-0.395
778.3	1.290	1.444	0.758	0.994	1.470	1.191	1.204	1.208	1.276	1.506	1.014	1.249	1.369	1.123	1.155	1.346	1.230	1.005	0.996	1.193	1.324	1.045	-0.399
779.8	1.291	1.445	0.758	1.000	1.470	1.190	1.205	1.212	1.275	1.505	1.011	1.250	1.371	1.123	1.157	1.349	1.234	1.012	1.004	1.196	1.322	1.046	-0.398
781.4	1.292	1.446	0.759	0.997	1.470	1.193	1.207	1.215	1.282	1.506	1.014	1.251	1.373	1.124	1.158	1.351	1.235	1.012	1.003	1.195	1.324	1.051	-0.400
783.0	1.292	1.448	0.760	1.000	1.472	1.196	1.210	1.214	1.278	1.506	1.019	1.252	1.373	1.127	1.159	1.353	1.234	1.021	1.008	1.194	1.324	1.045	-0.402
784.5	1.293	1.448	0.764	0.995	1.469	1.194	1.207	1.218	1.280	1.505	1.017	1.254	1.375	1.127	1.163	1.353	1.235	1.017	1.006	1.196	1.326	1.043	-0.403
786.1	1.295	1.451	0.766	0.999	1.472	1.195	1.210	1.220	1.281	1.505	1.015	1.254	1.378	1.129	1.163	1.357	1.236	1.020	1.011	1.199	1.324	1.052	-0.401
787.6	1.293	1.451	0.765	1.002	1.470	1.193	1.212	1.216	1.278	1.503	1.025	1.255	1.379	1.131	1.171	1.359	1.235	1.023	1.010	1.194	1.324	1.054	-0.404
789.2	1.293	1.453	0.772	1.002	1.470	1.193	1.209	1.220	1.278	1.502	1.023	1.259	1.381	1.130	1.172	1.359	1.235	1.031	1.015	1.191	1.324	1.049	-0.403
790.7	1.292	1.454	0.770	1.003	1.472	1.197	1.212	1.226	1.280	1.503	1.030	1.261	1.385	1.136	1.175	1.365	1.237	1.034	1.025	1.194	1.328	1.048	-0.405
792.3	1.296	1.457	0.774	1.001	1.472	1.198	1.214	1.221	1.283	1.506	1.031	1.263	1.385	1.137	1.176	1.365	1.241	1.029	1.021	1.199	1.326	1.048	-0.408
793.8	1.300	1.459	0.783	1.013	1.476	1.200	1.219	1.230	1.288	1.508	1.036	1.267	1.386	1.139	1.178	1.367	1.238	1.041	1.022	1.201	1.329	1.053	-0.407
795.4	1.298	1.461	0.792	1.011	1.475	1.207	1.218	1.232	1.287	1.508	1.042	1.267	1.391	1.143	1.183	1.369	1.245	1.039	1.030	1.199	1.329	1.057	-0.406
796.9	1.299	1.464	0.785	1.011	1.474	1.206	1.219	1.231	1.287	1.508	1.042	1.267	1.393	1.145	1.182	1.371	1.243	1.040	1.026	1.203	1.330	1.054	-0.409
798.4	1.302	1.464	0.783	1.014	1.476	1.204	1.221	1.231	1.287	1.505	1.045	1.268	1.393	1.149	1.184	1.373	1.240	1.044	1.033	1.209	1.331	1.058	-0.408
800.0	1.300	1.465	0.784	1.016	1.475	1.207	1.224	1.238	1.289	1.507	1.046	1.274	1.395	1.146	1.188	1.378	1.245	1.050	1.036	1.203	1.330	1.059	-0.411
801.5	1.300	1.468	0.789	1.018	1.479	1.208	1.221	1.237	1.290	1.508	1.048	1.272	1.397	1.148	1.189	1.378	1.245	1.052	1.039	1.208	1.333	1.060	-0.407
803.0	1.305	1.468	0.796	1.016	1.478	1.210	1.225	1.236	1.287	1.509	1.048	1.273	1.400	1.148	1.194	1.375	1.242	1.047	1.038	1.203	1.330	1.059	-0.407
804.6	1.305	1.468	0.789	1.022	1.478	1.212	1.224	1.240	1.294	1.509	1.050	1.274	1.399	1.153	1.192	1.378	1.244	1.053	1.039	1.206	1.336	1.062	-0.407
806.1	1.305	1.472	0.797	1.019	1.480	1.210	1.227	1.240	1.294	1.512	1.051	1.277	1.401	1.150	1.192	1.381	1.247	1.060	1.042	1.209	1.334	1.066	-0.409
807.6	1.306	1.471	0.793	1.017	1.480	1.213	1.225	1.240	1.296	1.512	1.055	1.275	1.401	1.155	1.192	1.380	1.250	1.055	1.037	1.214	1.331	1.053	-0.418
809.1	1.302	1.472	0.796	1.019	1.480	1.212	1.224	1.241	1.294	1.510	1.053	1.273	1.396	1.155	1.193	1.383	1.244	1.055	1.034	1.207	1.335	1.055	-0.413
810.7	1.301	1.470	0.799	1.012	1.475	1.210	1.222	1.233	1.286	1.504	1.047	1.276	1.394	1.148	1.200	1.380	1.247	1.060	1.042	1.206	1.328	1.054	-0.414
812.2	1.293	1.470	0.795	1.008	1.471	1.206	1.213	1.230	1.279	1.498	1.042	1.272	1.393	1.147	1.188	1.380	1.240	1.054	1.036	1.198	1.327	1.056	-0.407
813.7	1.287	1.466	0.791	0.997	1.466	1.204	1.215	1.228	1.276	1.490	1.037	1.268	1.388	1.149	1.194	1.379	1.232	1.047	1.026	1.191	1.320	1.045	-0.420
815.2	1.278	1.467	0.790	0.993	1.461	1.197	1.210	1.222	1.268	1.483	1.035	1.270	1.387	1.143	1.194	1.379	1.224	1.055	1.034	1.191	1.324	1.042	-0.413
816.7	1.276	1.468	0.774	0.997	1.458	1.190	1.207	1.217	1.256	1.477	1.030	1.263	1.384	1.135	1.186	1.374	1.217	1.048	1.027	1.185	1.321	1.031	-0.405
818.2	1.272	1.468	0.776	0.989	1.460	1.191	1.208	1.213	1.258	1.479	1.026	1.259	1.382	1.134	1.186	1.367	1.207	1.032	1.017	1.182	1.320	1.039	-0.403
819.7	1.275	1.466	0.771	0.978	1.458	1.182	1.205	1.210	1.255	1.480	1.022	1.252	1.379	1.128	1.178	1.354	1.200	1.028	1.011	1.180	1.317	1.028	-0.402
821.3	1.275	1.468	0.755	0.980	1.459	1.192	1.201	1.207	1.256	1.480	1.011	1.251	1.373	1.118	1.170	1.360	1.200	1.026	1.007	1.178	1.323	1.016	-0.397

822.8	1.270	1.459	0.754	0.972	1.456	1.184	1.199	1.200	1.250	1.475	0.998	1.245	1.367	1.115	1.166	1.353	1.185	1.014	0.998	1.165	1.313	1.014	-0.396
824.3	1.265	1.457	0.742	0.961	1.455	1.178	1.190	1.184	1.242	1.474	0.996	1.236	1.362	1.100	1.159	1.341	1.177	1.000	0.995	1.164	1.315	0.998	-0.387
825.8	1.266	1.457	0.740	0.960	1.453	1.171	1.187	1.185	1.240	1.474	0.970	1.229	1.346	1.087	1.149	1.332	1.170	0.987	0.975	1.158	1.311	1.013	-0.378
827.3	1.265	1.449	0.718	0.939	1.451	1.162	1.181	1.172	1.230	1.469	0.952	1.224	1.343	1.085	1.137	1.323	1.157	0.970	0.965	1.144	1.304	0.990	-0.380
828.8	1.252	1.441	0.713	0.923	1.445	1.155	1.169	1.161	1.218	1.463	0.937	1.216	1.333	1.067	1.132	1.310	1.141	0.947	0.957	1.146	1.304	0.977	-0.371
830.3	1.247	1.438	0.701	0.916	1.443	1.148	1.163	1.144	1.215	1.461	0.921	1.200	1.318	1.048	1.120	1.301	1.125	0.939	0.939	1.127	1.293	0.961	-0.367
831.7	1.247	1.433	0.698	0.910	1.441	1.145	1.159	1.132	1.212	1.461	0.903	1.193	1.313	1.049	1.111	1.290	1.109	0.917	0.916	1.128	1.297	0.964	-0.360
833.2	1.243	1.434	0.683	0.897	1.440	1.139	1.155	1.127	1.205	1.459	0.895	1.190	1.307	1.032	1.101	1.280	1.098	0.913	0.918	1.128	1.292	0.956	-0.356
834.7	1.239	1.430	0.673	0.892	1.441	1.140	1.152	1.125	1.201	1.459	0.892	1.188	1.304	1.026	1.102	1.277	1.098	0.895	0.910	1.115	1.291	0.964	-0.354
836.2	1.243	1.430	0.670	0.884	1.440	1.142	1.155	1.127	1.209	1.465	0.869	1.178	1.297	1.022	1.088	1.274	1.090	0.882	0.914	1.118	1.293	0.949	-0.344
837.7	1.249	1.430	0.671	0.880	1.442	1.138	1.150	1.122	1.208	1.465	0.865	1.179	1.299	1.018	1.087	1.273	1.093	0.882	0.900	1.114	1.293	0.944	-0.347
839.2	1.254	1.427	0.663	0.882	1.443	1.144	1.151	1.118	1.209	1.466	0.873	1.180	1.298	1.024	1.090	1.267	1.095	0.888	0.891	1.119	1.291	0.936	-0.360
840.7	1.251	1.426	0.657	0.881	1.442	1.144	1.150	1.120	1.218	1.467	0.874	1.176	1.301	1.013	1.080	1.263	1.089	0.866	0.907	1.120	1.288	0.957	-0.344
842.2	1.250	1.425	0.666	0.876	1.446	1.145	1.151	1.118	1.218	1.469	0.868	1.179	1.299	1.014	1.083	1.266	1.089	0.883	0.888	1.114	1.294	0.946	-0.354
843.6	1.249	1.429	0.664	0.877	1.447	1.139	1.147	1.120	1.213	1.468	0.855	1.172	1.295	1.022	1.085	1.264	1.085	0.869	0.892	1.125	1.289	0.940	-0.349
845.1	1.255	1.425	0.653	0.890	1.446	1.144	1.154	1.118	1.219	1.470	0.858	1.177	1.293	1.009	1.077	1.263	1.088	0.871	0.882	1.117	1.292	0.941	-0.348
846.6	1.254	1.425	0.660	0.877	1.447	1.145	1.154	1.125	1.216	1.472	0.852	1.170	1.297	1.019	1.074	1.262	1.081	0.864	0.887	1.127	1.299	0.945	-0.344
848.1	1.251	1.420	0.661	0.874	1.446	1.142	1.152	1.122	1.216	1.473	0.852	1.177	1.291	0.998	1.075	1.265	1.089	0.872	0.898	1.120	1.290	0.933	-0.347
849.5	1.251	1.423	0.656	0.878	1.448	1.146	1.146	1.116	1.217	1.470	0.856	1.171	1.293	1.014	1.077	1.260	1.083	0.858	0.893	1.122	1.292	0.929	-0.344
851.0	1.254	1.423	0.651	0.868	1.446	1.138	1.152	1.110	1.223	1.466	0.841	1.171	1.293	1.010	1.075	1.261	1.077	0.856	0.870	1.121	1.289	0.929	-0.353
852.5	1.251	1.423	0.649	0.871	1.446	1.143	1.149	1.120	1.214	1.468	0.849	1.174	1.294	1.007	1.075	1.260	1.088	0.873	0.895	1.117	1.293	0.932	-0.348
854.0	1.249	1.420	0.658	0.871	1.446	1.145	1.150	1.112	1.216	1.467	0.843	1.169	1.293	1.009	1.071	1.262	1.068	0.849	0.870	1.115	1.288	0.935	-0.347
855.4	1.246	1.421	0.659	0.863	1.442	1.138	1.155	1.110	1.213	1.462	0.839	1.168	1.292	1.000	1.073	1.260	1.073	0.854	0.872	1.103	1.290	0.937	-0.344
856.9	1.254	1.422	0.649	0.867	1.443	1.141	1.150	1.104	1.212	1.461	0.825	1.164	1.288	1.004	1.069	1.257	1.075	0.833	0.875	1.119	1.292	0.931	-0.336
858.4	1.249	1.418	0.645	0.863	1.439	1.138	1.147	1.103	1.208	1.464	0.825	1.164	1.289	0.990	1.063	1.247	1.060	0.850	0.868	1.110	1.293	0.929	-0.336
859.8	1.251	1.423	0.625	0.870	1.444	1.135	1.154	1.101	1.214	1.466	0.838	1.162	1.290	0.995	1.067	1.254	1.062	0.864	0.882	1.104	1.287	0.937	-0.341
861.3	1.254	1.421	0.639	0.862	1.440	1.142	1.148	1.110	1.218	1.463	0.836	1.160	1.284	1.007	1.070	1.255	1.060	0.853	0.877	1.110	1.291	0.921	-0.345
862.8	1.250	1.419	0.638	0.861	1.445	1.141	1.148	1.103	1.214	1.466	0.830	1.166	1.291	0.988	1.066	1.258	1.066	0.855	0.859	1.110	1.296	0.918	-0.347
864.2	1.252	1.421	0.653	0.856	1.444	1.139	1.148	1.115	1.224	1.466	0.836	1.168	1.288	0.997	1.065	1.250	1.060	0.853	0.872	1.112	1.292	0.922	-0.344
865.7	1.258	1.419	0.632	0.866	1.448	1.150	1.151	1.100	1.220	1.468	0.821	1.171	1.289	0.994	1.069	1.252	1.065	0.848	0.879	1.120	1.294	0.919	-0.340

867.2	1.255	1.420	0.650	0.862	1.448	1.142	1.151	1.106	1.211	1.470	0.836	1.166	1.294	0.977	1.070	1.263	1.051	0.836	0.871	1.117	1.295	0.924	-0.334
868.6	1.257	1.422	0.630	0.857	1.448	1.140	1.151	1.111	1.216	1.472	0.843	1.169	1.289	0.988	1.070	1.252	1.066	0.823	0.865	1.110	1.294	0.934	-0.342
870.1	1.256	1.422	0.645	0.858	1.448	1.145	1.145	1.107	1.221	1.474	0.840	1.166	1.291	0.985	1.063	1.255	1.050	0.822	0.852	1.113	1.294	0.914	-0.341
871.5	1.260	1.424	0.629	0.860	1.448	1.138	1.151	1.107	1.222	1.474	0.838	1.172	1.295	0.996	1.067	1.253	1.048	0.835	0.872	1.117	1.294	0.913	-0.342
873.0	1.265	1.422	0.651	0.853	1.448	1.142	1.146	1.104	1.221	1.476	0.835	1.175	1.288	0.982	1.064	1.248	1.056	0.841	0.869	1.115	1.299	0.921	-0.337
874.5	1.257	1.424	0.642	0.852	1.455	1.141	1.151	1.104	1.221	1.478	0.836	1.162	1.288	0.992	1.067	1.250	1.054	0.825	0.872	1.105	1.300	0.919	-0.333
875.9	1.262	1.425	0.627	0.850	1.455	1.147	1.146	1.099	1.225	1.476	0.834	1.169	1.290	0.985	1.071	1.259	1.046	0.838	0.857	1.121	1.298	0.911	-0.348
877.4	1.259	1.421	0.651	0.850	1.451	1.132	1.151	1.105	1.220	1.472	0.837	1.170	1.287	0.993	1.062	1.243	1.048	0.830	0.867	1.116	1.296	0.922	-0.336
878.8	1.259	1.424	0.637	0.850	1.453	1.147	1.147	1.095	1.218	1.477	0.839	1.168	1.288	0.981	1.065	1.245	1.040	0.825	0.856	1.118	1.299	0.913	-0.338
880.3	1.258	1.423	0.637	0.848	1.455	1.148	1.150	1.101	1.218	1.473	0.836	1.167	1.290	0.976	1.070	1.239	1.029	0.816	0.857	1.114	1.294	0.909	-0.336
881.7	1.261	1.423	0.639	0.851	1.452	1.140	1.146	1.101	1.216	1.472	0.825	1.166	1.286	0.990	1.062	1.242	1.033	0.814	0.841	1.114	1.292	0.909	-0.340
883.2	1.256	1.429	0.618	0.836	1.452	1.141	1.150	1.091	1.218	1.474	0.822	1.164	1.284	0.976	1.062	1.241	1.037	0.822	0.856	1.112	1.296	0.902	-0.340
884.7	1.261	1.430	0.633	0.838	1.452	1.138	1.143	1.096	1.214	1.469	0.836	1.156	1.280	0.972	1.070	1.239	1.022	0.814	0.854	1.106	1.298	0.895	-0.332
886.1	1.254	1.426	0.634	0.826	1.450	1.139	1.139	1.094	1.218	1.474	0.811	1.169	1.283	0.968	1.071	1.245	1.029	0.817	0.857	1.103	1.298	0.908	-0.334
887.6	1.256	1.428	0.617	0.833	1.450	1.134	1.141	1.100	1.209	1.471	0.818	1.156	1.284	0.968	1.051	1.245	1.028	0.799	0.849	1.107	1.290	0.909	-0.332
889.0	1.252	1.425	0.622	0.829	1.447	1.140	1.142	1.085	1.209	1.470	0.803	1.162	1.272	0.977	1.060	1.240	1.023	0.794	0.853	1.108	1.301	0.894	-0.328
890.5	1.247	1.424	0.628	0.832	1.446	1.139	1.134	1.081	1.206	1.467	0.804	1.162	1.272	0.970	1.052	1.243	1.020	0.795	0.833	1.101	1.294	0.899	-0.330
891.9	1.249	1.428	0.624	0.813	1.440	1.126	1.133	1.077	1.196	1.460	0.803	1.164	1.279	0.961	1.066	1.248	1.003	0.790	0.860	1.107	1.297	0.934	-0.318
893.4	1.235	1.422	0.627	0.814	1.438	1.125	1.124	1.075	1.189	1.448	0.779	1.151	1.272	0.982	1.060	1.243	1.023	0.806	0.842	1.093	1.280	0.886	-0.336
894.9	1.227	1.416	0.612	0.825	1.433	1.118	1.125	1.075	1.184	1.436	0.782	1.160	1.277	0.983	1.057	1.243	1.009	0.817	0.843	1.088	1.279	0.872	-0.338
896.3	1.212	1.420	0.646	0.819	1.425	1.118	1.122	1.060	1.175	1.426	0.796	1.162	1.269	0.966	1.063	1.244	1.006	0.850	0.844	1.064	1.286	0.894	-0.329
897.8	1.216	1.424	0.641	0.814	1.424	1.121	1.127	1.060	1.173	1.426	0.770	1.161	1.278	0.961	1.058	1.225	0.951	0.809	0.868	1.092	1.279	0.870	-0.306
899.2	1.202	1.423	0.618	0.818	1.418	1.118	1.127	1.046	1.154	1.422	0.777	1.154	1.279	0.962	1.072	1.236	0.961	0.784	0.842	1.066	1.287	0.926	-0.301
900.7	1.211	1.425	0.639	0.799	1.421	1.118	1.138	1.068	1.152	1.421	0.777	1.141	1.275	0.947	1.062	1.233	0.983	0.809	0.844	1.068	1.279	0.880	-0.317
902.1	1.217	1.432	0.640	0.787	1.424	1.115	1.117	1.057	1.166	1.424	0.762	1.155	1.273	0.950	1.061	1.231	0.953	0.820	0.839	1.071	1.291	0.865	-0.312
903.6	1.221	1.423	0.647	0.801	1.424	1.118	1.118	1.061	1.164	1.437	0.767	1.134	1.270	0.944	1.061	1.222	0.978	0.790	0.824	1.073	1.291	0.903	-0.303
905.1	1.217	1.424	0.631	0.824	1.428	1.130	1.128	1.065	1.154	1.419	0.769	1.137	1.262	0.983	1.066	1.239	0.990	0.847	0.839	1.088	1.283	0.884	-0.329
906.5	1.208	1.426	0.622	0.843	1.419	1.117	1.118	1.046	1.152	1.418	0.744	1.144	1.263	0.927	1.073	1.246	0.964	0.829	0.829	1.065	1.279	0.855	-0.305
908.0	1.213	1.424	0.620	0.801	1.413	1.123	1.111	1.063	1.152	1.417	0.787	1.141	1.269	0.943	1.068	1.244	0.977	0.839	0.835	1.054	1.298	0.836	-0.323
909.4	1.215	1.422	0.635	0.805	1.416	1.126	1.109	1.054	1.144	1.415	0.778	1.156	1.264	0.963	1.074	1.239	0.984	0.797	0.866	1.092	1.273	0.850	-0.319

910.9	1.189	1.422	0.616	0.811	1.414	1.104	1.114	1.044	1.150	1.411	0.760	1.137	1.276	0.961	1.065	1.232	0.979	0.798	0.868	1.067	1.291	0.872	-0.295
912.4	1.204	1.423	0.616	0.819	1.416	1.096	1.113	1.053	1.148	1.399	0.739	1.167	1.276	0.940	1.068	1.247	0.961	0.804	0.853	1.070	1.284	0.895	-0.297
913.8	1.197	1.423	0.640	0.800	1.416	1.119	1.109	1.023	1.149	1.400	0.759	1.137	1.287	0.951	1.083	1.237	0.963	0.838	0.859	1.061	1.291	0.851	-0.303
915.3	1.213	1.437	0.653	0.788	1.411	1.110	1.113	1.019	1.149	1.406	0.795	1.141	1.278	0.954	1.054	1.228	0.964	0.808	0.871	1.067	1.294	0.852	-0.289
916.7	1.201	1.427	0.611	0.813	1.419	1.122	1.127	1.019	1.160	1.408	0.732	1.133	1.270	0.949	1.078	1.244	0.927	0.774	0.879	1.051	1.294	0.866	-0.271
918.2	1.212	1.428	0.626	0.819	1.421	1.109	1.121	1.063	1.140	1.424	0.747	1.138	1.260	0.929	1.056	1.214	0.930	0.787	0.822	1.070	1.295	0.854	-0.287
919.7	1.206	1.429	0.652	0.793	1.423	1.108	1.124	1.029	1.154	1.413	0.759	1.136	1.250	0.936	1.058	1.226	0.947	0.819	0.797	1.058	1.278	0.901	-0.312
921.1	1.205	1.429	0.636	0.786	1.423	1.131	1.121	1.053	1.161	1.416	0.669	1.157	1.251	0.949	1.058	1.216	0.989	0.753	0.827	1.075	1.296	0.869	-0.291
922.6	1.200	1.423	0.599	0.792	1.412	1.118	1.130	1.026	1.160	1.412	0.773	1.127	1.253	0.920	1.020	1.212	0.940	0.781	0.862	1.058	1.286	0.873	-0.282
924.1	1.202	1.429	0.609	0.797	1.413	1.104	1.111	1.023	1.139	1.397	0.723	1.118	1.259	0.948	1.076	1.235	0.969	0.780	0.819	1.072	1.284	0.889	-0.301
925.6	1.178	1.412	0.647	0.789	1.404	1.109	1.100	1.031	1.153	1.398	0.752	1.134	1.255	0.964	1.073	1.246	0.943	0.819	0.809	1.046	1.275	0.847	-0.326
927.0	1.176	1.420	0.635	0.802	1.400	1.115	1.107	1.028	1.123	1.379	0.734	1.151	1.262	0.974	1.094	1.251	0.976	0.898	0.877	1.073	1.303	0.871	-0.312
928.5	1.197	1.422	0.727	0.836	1.396	1.132	1.110	1.054	1.157	1.374	0.836	1.149	1.272	1.003	1.103	1.291	1.037	0.844	0.833	1.116	1.300	0.888	-0.337
930.0	1.188	1.410	0.704	0.874	1.418	1.126	1.105	1.091	1.143	1.395	0.879	1.172	1.293	0.958	1.100	1.279	1.011	0.968	0.919	1.080	1.289	0.960	-0.316
931.4	1.175	1.424	0.716	0.909	1.411	1.189	1.117	1.124	1.207	1.405	0.926	1.223	1.322	1.051	1.167	1.364	1.162	0.974	0.961	1.135	1.381	1.015	-0.344
932.9	1.226	1.434	0.783	0.949	1.413	1.130	1.123	1.126	1.197	1.350	0.924	1.202	1.326	1.077	1.169	1.354	1.154	0.940	0.959	1.138	1.351	1.077	-0.295
934.4	1.203	1.421	0.658	0.835	1.419	1.156	1.157	1.131	1.185	1.372	0.945	1.170	1.319	1.084	1.189	1.363	1.071	1.115	0.930	1.025	1.347	0.935	-0.416
935.9	1.147	1.453	0.726	0.835	1.386	1.120	1.153	1.095	1.153	1.326	0.809	1.176	1.342	1.027	1.174	1.269	1.106	1.004	1.005	1.054	1.283	1.029	-0.303
937.4	1.177	1.440	0.722	0.831	1.412	1.116	1.112	1.024	1.114	1.376	0.852	1.138	1.277	1.003	1.070	1.298	1.096	0.918	0.934	1.004	1.323	0.925	-0.266
938.8	1.163	1.450	0.599	0.819	1.380	1.151	1.150	1.021	1.116	1.342	0.817	1.162	1.278	1.019	1.156	1.334	1.024	0.887	0.896	1.075	1.330	0.880	-0.339
940.3	1.173	1.436	0.792	0.854	1.425	1.122	1.129	1.067	1.165	1.395	0.888	1.205	1.281	1.022	1.178	1.265	1.046	0.884	1.046	1.087	1.374	0.948	-0.219
941.8	1.172	1.433	0.661	0.907	1.418	1.104	1.156	1.093	1.136	1.353	0.871	1.177	1.289	0.990	1.118	1.322	1.003	0.870	1.014	1.099	1.293	0.961	-0.260
943.3	1.168	1.454	0.784	0.840	1.404	1.192	1.097	1.099	1.114	1.374	0.805	1.182	1.310	0.961	1.135	1.345	1.049	0.929	0.918	1.041	1.332	0.988	-0.262
944.8	1.159	1.434	0.686	0.872	1.396	1.092	1.124	1.036	1.206	1.371	0.838	1.118	1.305	0.984	1.121	1.389	1.023	0.911	0.961	1.046	1.364	0.912	-0.253
946.3	1.172	1.436	0.720	0.847	1.394	1.097	1.134	1.040	1.127	1.356	0.787	1.158	1.287	1.036	1.163	1.298	1.035	0.981	0.886	1.083	1.364	1.008	-0.293
947.8	1.163	1.432	0.725	0.831	1.394	1.126	1.097	1.092	1.188	1.424	0.744	1.153	1.310	0.990	1.105	1.320	1.010	0.955	0.921	1.034	1.288	0.932	-0.300
949.3	1.152	1.416	0.721	0.792	1.385	1.131	1.132	1.061	1.134	1.370	0.779	1.163	1.311	0.903	1.137	1.292	0.968	1.022	1.027	1.134	1.313	0.893	-0.278
950.7	1.159	1.431	0.829	0.837	1.402	1.128	1.169	1.131	1.152	1.339	0.799	1.168	1.311	1.029	1.094	1.325	1.129	1.114	0.856	1.028	1.389	1.051	-0.301
952.2	1.154	1.442	0.690	0.942	1.426	1.127	1.171	0.993	1.156	1.350	0.816	1.127	1.312	0.974	1.120	1.313	1.087	0.989	0.980	1.095	1.320	0.880	-0.256
953.7	1.187	1.425	0.767	0.833	1.401	1.191	1.141	1.020	1.145	1.378	0.685	1.151	1.248	0.881	1.148	1.285	1.022	0.755	0.974	1.169	1.301	1.030	-0.195

955.2	1.170	1.441	0.751	0.824	1.396	1.132	1.160	1.038	1.121	1.355	0.850	1.121	1.334	0.960	1.138	1.274	1.044	0.851	0.933	1.041	1.315	0.990	-0.244
956.7	1.157	1.444	0.659	0.830	1.387	1.177	1.178	1.037	1.120	1.396	0.833	1.186	1.295	0.929	1.166	1.323	0.990	0.941	0.980	1.151	1.356	0.786	-0.307
958.2	1.197	1.439	0.674	0.785	1.415	1.186	1.114	1.043	1.141	1.370	0.738	1.165	1.278	0.972	1.110	1.349	1.085	0.897	0.957	1.090	1.250	0.887	-0.338
959.7	1.184	1.444	0.653	0.898	1.404	1.112	1.148	1.043	1.133	1.364	0.722	1.167	1.298	1.059	1.097	1.276	0.953	0.863	0.896	1.091	1.280	0.977	-0.270
961.2	1.186	1.442	0.641	0.824	1.406	1.156	1.166	1.041	1.158	1.366	0.732	1.189	1.267	0.990	1.121	1.247	1.059	0.844	0.930	1.196	1.308	0.941	-0.315
962.8	1.206	1.450	0.660	0.806	1.412	1.151	1.152	1.024	1.140	1.368	0.706	1.130	1.246	1.029	1.060	1.250	0.869	0.849	0.898	1.114	1.301	0.878	-0.268
964.3	1.186	1.441	0.693	0.873	1.415	1.120	1.123	1.053	1.158	1.393	0.784	1.139	1.277	0.975	1.110	1.250	1.003	0.779	0.861	1.083	1.278	0.812	-0.289
965.8	1.219	1.446	0.636	0.839	1.414	1.133	1.145	1.006	1.134	1.382	0.671	1.160	1.253	0.867	1.085	1.229	0.955	0.873	0.773	1.074	1.358	0.873	-0.266
967.3	1.219	1.447	0.630	0.764	1.408	1.143	1.151	1.052	1.124	1.396	0.754	1.147	1.242	0.933	1.089	1.237	0.871	0.780	0.903	1.075	1.358	0.847	-0.248
968.8	1.220	1.431	0.588	0.780	1.421	1.141	1.124	1.041	1.150	1.397	0.655	1.142	1.268	0.927	1.051	1.244	0.935	0.814	0.887	1.112	1.305	0.919	-0.273
970.3	1.204	1.443	0.702	0.862	1.430	1.156	1.150	1.074	1.169	1.397	0.773	1.173	1.252	0.948	1.060	1.261	0.913	0.782	0.897	1.055	1.354	0.907	-0.213
971.8	1.209	1.430	0.669	0.789	1.420	1.160	1.165	1.069	1.147	1.411	0.694	1.146	1.264	0.924	1.108	1.233	0.957	0.858	0.850	1.098	1.276	0.863	-0.320
973.3	1.232	1.415	0.657	0.805	1.421	1.131	1.133	1.013	1.148	1.422	0.824	1.133	1.274	0.921	1.097	1.254	0.969	0.812	0.917	1.030	1.338	0.971	-0.242
974.9	1.218	1.439	0.713	0.846	1.416	1.123	1.143	1.058	1.192	1.401	0.798	1.142	1.273	0.926	1.097	1.275	0.890	0.764	0.901	1.107	1.281	0.847	-0.257
976.4	1.231	1.437	0.748	0.814	1.434	1.139	1.141	0.979	1.140	1.394	0.767	1.108	1.265	0.967	1.071	1.268	0.990	0.854	0.840	1.073	1.323	0.932	-0.259
977.9	1.208	1.450	0.626	0.810	1.422	1.155	1.147	1.074	1.163	1.408	0.708	1.159	1.250	0.925	1.104	1.234	0.951	0.874	0.885	1.107	1.380	0.933	-0.261
979.4	1.246	1.441	0.698	0.835	1.432	1.139	1.133	1.081	1.164	1.414	0.742	1.144	1.282	0.902	1.043	1.230	0.917	0.779	0.846	1.168	1.288	0.907	-0.261
980.9	1.229	1.451	0.632	0.860	1.447	1.185	1.151	1.023	1.169	1.406	0.777	1.138	1.282	1.013	1.041	1.193	0.987	0.817	0.803	1.042	1.341	0.777	-0.286
982.5	1.217	1.440	0.714	0.762	1.436	1.140	1.193	1.053	1.178	1.440	0.679	1.135	1.260	0.960	1.114	1.259	0.966	0.782	0.841	1.110	1.326	0.868	-0.295
984.0	1.257	1.452	0.606	0.780	1.442	1.199	1.168	1.084	1.187	1.436	0.796	1.148	1.282	0.960	1.045	1.247	0.971	0.799	0.772	1.125	1.295	0.855	-0.361
985.5	1.258	1.442	0.598	0.821	1.446	1.170	1.175	1.030	1.195	1.448	0.765	1.159	1.280	0.907	1.073	1.252	0.968	0.767	0.887	1.070	1.307	0.938	-0.273
987.1	1.259	1.452	0.678	0.881	1.461	1.163	1.190	1.070	1.189	1.451	0.821	1.171	1.263	0.936	1.038	1.271	0.963	0.787	0.913	1.101	1.318	0.902	-0.248
988.6	1.246	1.446	0.667	0.785	1.447	1.183	1.184	1.082	1.207	1.447	0.766	1.143	1.265	0.975	1.087	1.278	1.008	0.793	0.876	1.113	1.338	0.827	-0.315
990.1	1.261	1.440	0.707	0.861	1.467	1.150	1.158	1.053	1.209	1.443	0.789	1.133	1.265	0.952	1.065	1.212	0.948	0.845	0.812	1.154	1.323	0.913	-0.288
991.6	1.257	1.446	0.595	0.851	1.448	1.184	1.141	1.105	1.208	1.445	0.803	1.150	1.278	0.957	1.098	1.225	0.964	0.860	0.906	1.094	1.373	0.913	-0.275
993.2	1.255	1.468	0.665	0.811	1.454	1.204	1.154	1.112	1.188	1.441	0.757	1.142	1.302	0.960	1.092	1.254	0.965	0.692	0.904	1.131	1.329	0.961	-0.245
994.7	1.272	1.463	0.685	0.882	1.463	1.161	1.188	1.070	1.215	1.463	0.799	1.175	1.280	0.929	1.100	1.261	1.035	0.789	0.841	1.186	1.298	0.792	-0.322
996.2	1.236	1.446	0.686	0.859	1.463	1.212	1.193	1.115	1.214	1.483	0.798	1.200	1.301	0.962	1.114	1.232	0.944	0.823	0.895	1.101	1.356	0.905	-0.276
997.8	1.275	1.472	0.623	0.797	1.447	1.165	1.203	1.065	1.238	1.446	0.878	1.149	1.285	0.959	1.119	1.262	1.054	0.859	0.853	1.158	1.341	0.884	-0.363
999.3	1.274	1.451	0.669	0.847	1.474	1.197	1.185	1.107	1.187	1.465	0.805	1.191	1.286	0.975	1.084	1.269	0.967	0.886	0.817	1.173	1.377	0.872	-0.328

1000.9	1.260	1.468	0.461	0.833	1.455	1.137	1.189	1.081	1.229	1.457	0.872	1.156	1.309	0.938	1.084	1.319	0.882	0.855	0.859	1.156	1.327	0.732	-0.361
1002.4	1.275	1.462	0.708	0.783	1.457	1.182	1.201	1.117	1.194	1.470	0.830	1.228	1.288	0.950	1.019	1.271	0.956	0.845	0.922	1.189	1.328	0.874	-0.308
1003.9	1.253	1.472	0.649	0.909	1.472	1.233	1.186	1.135	1.229	1.464	0.853	1.184	1.332	1.031	1.111	1.264	1.012	0.684	0.906	1.186	1.331	0.963	-0.275
1005.5	1.272	1.468	0.747	0.901	1.478	1.203	1.203	1.170	1.244	1.473	0.844	1.185	1.328	1.013	1.116	1.285	1.048	0.854	0.909	1.138	1.366	0.891	-0.292
1007.0	1.281	1.472	0.667	0.828	1.477	1.209	1.241	1.086	1.242	1.463	0.901	1.223	1.297	1.008	1.112	1.300	1.003	0.862	0.910	1.128	1.391	0.879	-0.327
1008.5	1.279	1.452	0.725	0.885	1.469	1.187	1.205	1.140	1.232	1.477	0.851	1.181	1.309	0.988	1.150	1.294	1.018	0.823	0.927	1.135	1.340	0.870	-0.301
1010.1	1.274	1.454	0.624	0.940	1.471	1.193	1.210	1.101	1.267	1.469	0.715	1.184	1.318	1.006	1.076	1.296	0.963	0.920	1.028	1.146	1.373	0.763	-0.242
1011.6	1.296	1.479	0.720	0.890	1.480	1.182	1.226	1.170	1.240	1.485	0.749	1.191	1.326	1.071	1.144	1.257	1.114	0.921	0.872	1.165	1.354	0.938	-0.339
1013.1	1.307	1.467	0.688	0.830	1.463	1.208	1.187	1.117	1.249	1.436	0.920	1.177	1.326	1.075	1.087	1.296	1.048	0.887	0.892	1.196	1.388	0.976	-0.342
1014.7	1.312	1.453	0.567	0.835	1.490	1.227	1.205	1.136	1.257	1.479	1.004	1.172	1.350	0.958	1.081	1.306	0.975	0.823	0.960	1.199	1.326	0.957	-0.339
1016.2	1.299	1.464	0.744	1.042	1.474	1.248	1.197	1.095	1.291	1.457	0.839	1.201	1.315	1.043	1.135	1.325	1.067	0.884	0.997	1.094	1.378	1.012	-0.200
1017.7	1.283	1.487	0.718	0.892	1.466	1.216	1.229	1.130	1.220	1.497	0.792	1.157	1.307	0.998	1.093	1.259	1.097	0.984	0.915	1.148	1.386	0.917	-0.295
1019.3	1.273	1.482	0.762	0.861	1.474	1.210	1.248	1.136	1.274	1.462	0.856	1.242	1.331	0.957	1.131	1.282	0.956	0.819	1.044	1.202	1.368	1.030	-0.224
1020.8	1.318	1.489	0.800	0.952	1.491	1.203	1.204	1.182	1.265	1.502	0.968	1.240	1.353	1.013	1.098	1.255	1.055	1.003	0.917	1.202	1.356	1.041	-0.312
1022.3	1.313	1.487	0.791	0.891	1.499	1.251	1.209	1.116	1.287	1.472	0.916	1.196	1.318	1.015	1.117	1.356	1.063	0.916	1.033	1.211	1.340	0.886	-0.299
1023.9	1.298	1.477	0.777	0.932	1.483	1.167	1.261	1.167	1.265	1.481	0.819	1.198	1.337	1.006	1.083	1.361	1.052	0.903	1.011	1.186	1.336	1.108	-0.241
1025.4	1.294	1.489	0.812	0.892	1.467	1.264	1.242	1.180	1.291	1.478	0.824	1.245	1.385	0.976	1.095	1.338	1.031	0.764	0.941	1.175	1.389	0.801	-0.255
1026.9	1.316	1.484	0.701	1.029	1.511	1.291	1.216	1.182	1.261	1.493	0.825	1.217	1.393	1.018	1.136	1.374	0.992	0.901	0.951	1.109	1.414	0.948	-0.230
1028.4	1.301	1.505	0.743	0.846	1.490	1.169	1.236	1.172	1.317	1.482	0.985	1.222	1.341	1.022	1.192	1.337	1.214	0.969	0.989	1.252	1.378	0.999	-0.391
1030.0	1.317	1.472	0.931	1.026	1.512	1.272	1.291	1.169	1.265	1.504	0.909	1.237	1.386	1.039	1.113	1.366	1.212	0.880	1.130	1.226	1.299	1.070	-0.202
1031.5	1.310	1.494	0.792	0.916	1.476	1.204	1.314	1.184	1.322	1.524	1.104	1.226	1.331	0.876	1.160	1.287	1.151	0.798	0.946	1.141	1.372	0.894	-0.299
1033.0	1.333	1.508	0.833	0.963	1.490	1.261	1.207	1.209	1.290	1.486	1.023	1.227	1.374	1.106	1.184	1.378	1.050	0.911	0.790	1.228	1.409	1.008	-0.365
1034.5	1.353	1.498	0.938	0.966	1.496	1.259	1.158	1.120	1.266	1.471	0.930	1.180	1.420	1.129	1.204	1.371	0.956	0.810	1.060	1.187	1.372	1.026	-0.153
1036.0	1.335	1.539	0.860	0.931	1.493	1.220	1.379	1.175	1.228	1.480	0.893	1.265	1.392	1.015	1.101	1.417	1.254	1.158	0.662	1.297	1.350	1.039	-0.463
1037.5	1.349	1.482	0.912	0.925	1.481	1.206	1.220	1.249	1.270	1.508	0.944	1.230	1.407	1.133	1.169	1.368	1.250	0.986	1.101	1.294	1.360	1.024	-0.320
1039.0	1.296	1.478	0.719	1.026	1.524	1.231	1.288	1.178	1.292	1.544	1.141	1.294	1.407	1.061	1.215	1.382	1.270	0.915	0.979	1.257	1.373	1.077	-0.392
1040.5	1.333	1.502	0.911	1.021	1.545	1.341	1.272	1.260	1.314	1.530	0.932	1.285	1.353	1.251	1.084	1.486	0.991	0.948	1.020	1.194	1.362	0.948	-0.294
1042.0	1.351	1.524	0.872	0.986	1.460	1.270	1.242	1.193	1.307	1.518	1.022	1.309	1.420	1.085	1.230	1.444	1.178	1.034	1.050	1.168	1.517	1.098	-0.253
1043.5	1.374	1.508	0.959	0.925	1.524	1.254	1.341	1.255	1.373	1.516	0.973	1.246	1.430	0.980	1.299	1.338	1.319	1.059	1.003	1.279	1.397	0.932	-0.380
1045.0	1.290	1.512	0.942	1.066	1.492	1.272	1.221	1.231	1.218	1.511	1.032	1.375	1.370	1.099	1.147	1.379	1.245	0.805	1.212	1.276	1.293	1.066	-0.190

1046.5	1.366	1.511	0.873	1.028	1.541	1.271	1.303	1.270	1.257	1.445	1.124	1.214	1.348	1.235	1.240	1.430	0.967	1.157	0.803	1.177	1.468	1.011	-0.390
1048.0	1.274	1.520	0.751	1.045	1.511	1.326	1.242	1.213	1.401	1.510	1.000	1.367	1.456	1.086	1.281	1.372	1.205	1.153	1.003	1.248	1.355	0.949	-0.449
1049.5	1.306	1.523	0.742	1.067	1.478	1.342	1.324	1.270	1.351	1.536	1.056	1.309	1.473	0.942	1.308	1.489	1.299	0.981	1.165	1.281	1.402	0.983	-0.325
1050.9	1.292	1.477	0.929	1.033	1.563	1.272	1.377	1.286	1.260	1.489	1.201	1.269	1.437	1.239	1.363	1.370	1.321	1.130	1.135	1.322	1.197	1.219	-0.565
1052.4	1.334	1.536	0.962	1.123	1.538	1.233	1.260	1.332	1.214	1.518	1.182	1.265	1.297	1.121	1.200	1.506	1.128	0.838	1.055	1.381	1.358	1.139	-0.248
1053.9	1.387	1.547	0.926	1.043	1.441	1.355	1.304	1.185	1.402	1.448	1.081	1.431	1.410	1.163	1.372	1.405	1.155	1.135	1.075	1.374	1.509	1.059	-0.368
1055.3	1.414	1.529	0.722	1.086	1.509	1.300	1.259	1.413	1.355	1.557	1.112	1.323	1.474	1.219	1.293	1.423	1.220	1.255	1.224	1.277	1.353	0.977	-0.432
1056.8	1.314	1.525	0.953	1.180	1.531	1.225	1.295	1.252	1.403	1.539	1.123	1.276	1.424	1.205	1.314	1.376	1.150	1.182	1.291	1.071	1.458	1.247	-0.085
1058.2	1.450	1.577	0.925	1.115	1.502	1.240	1.320	1.334	1.338	1.505	0.725	1.323	1.450	1.257	1.409	1.436	1.339	1.195	1.253	1.442	1.608	0.604	-0.222
1059.6	1.315	1.533	0.701	1.012	1.566	1.260	1.349	1.229	1.460	1.537	1.286	1.345	1.468	1.194	1.333	1.557	1.291	1.164	0.858	1.365	1.432	1.227	-0.570
1061.1	1.386	1.565	0.774	1.135	1.566	1.471	1.245	1.312	1.292	1.543	1.151	1.318	1.446	1.245	1.238	1.432	1.428	1.191	1.123	1.331	1.404	1.255	-0.402
1062.5	1.360	1.535	1.267	1.102	1.543	1.313	1.428	1.236	1.305	1.467	1.095	1.243	1.427	1.370	1.336	1.488	1.161	1.109	1.284	1.222	1.346	1.142	-0.157
1063.9	1.481	1.582	1.038	1.181	1.554	1.333	1.382	1.351	1.404	1.501	0.892	1.358	1.447	1.221	1.221	1.592	1.286	1.034	1.100	1.344	1.473	1.041	-0.246
1065.3	1.373	1.628	1.003	1.199	1.561	1.315	1.365	1.322	1.418	1.651	1.331	1.388	1.533	1.292	1.221	1.492	1.426	1.363	1.059	1.408	1.385	1.230	-0.504
1066.7	1.386	1.577	0.963	1.160	1.568	1.286	1.373	1.523	1.435	1.522	0.793	1.380	1.455	1.375	1.288	1.423	1.409	1.232	1.116	1.355	1.408	1.196	-0.366
1068.1	1.219	1.649	0.970	1.203	1.594	1.468	1.439	1.304	1.268	1.520	1.282	1.431	1.474	1.257	1.218	1.543	1.340	1.209	1.374	1.126	1.524	1.252	-0.117
1069.4	1.411	1.598	0.983	1.244	1.520	1.355	1.427	1.283	1.346	1.492	1.077	1.353	1.491	1.243	1.301	1.485	1.426	1.084	1.087	1.363	1.426	1.148	-0.329
1070.8	1.406	1.556	1.020	1.161	1.480	1.325	1.352	1.450	1.402	1.452	1.183	1.373	1.626	1.369	1.156	1.583	1.337	1.422	1.075	1.378	1.330	1.061	-0.520
1072.1	1.328	1.604	1.047	1.123	1.615	1.377	1.247	1.284	1.326	1.589	1.035	1.430	1.524	1.123	1.441	1.543	1.372	1.133	0.962	1.477	1.415	1.362	-0.396
1073.5	1.403	1.593	1.056	1.206	1.539	1.459	1.394	1.405	1.324	1.507	1.319	1.297	1.497	1.279	1.225	1.431	1.366	1.328	1.234	0.947	1.311	0.969	-0.273
1074.8	1.389	1.568	0.619	1.217	1.599	1.339	1.404	1.354	1.412	1.578	1.127	1.366	1.573	1.164	1.279	1.595	1.520	1.281	1.178	1.430	1.592	1.298	-0.353
1076.1	1.521	1.611	1.039	1.074	1.495	1.127	1.454	1.373	1.375	1.537	1.236	1.463	1.486	1.333	1.294	1.613	1.228	1.124	0.940	1.470	1.231	1.019	-0.577
1077.4	1.369	1.523	0.979	1.013	1.617	1.381	1.413	1.319	1.333	1.618	1.268	1.405	1.598	1.289	1.387	1.543	1.443	1.304	1.410	1.295	1.312	0.703	-0.454
1078.7	1.463	1.606	1.066	1.282	1.685	1.251	1.374	1.185	1.500	1.607	1.215	1.422	1.564	0.936	1.450	1.484	1.270	1.170	1.309	1.392	1.493	1.228	-0.118
1080.0	1.393	1.666	0.876	1.135	1.565	1.351	1.498	1.450	1.396	1.594	1.135	1.520	1.596	1.211	1.460	1.568	1.374	1.109	1.164	1.323	1.597	1.146	-0.360
1081.3	1.458	1.630	0.636	1.096	1.601	1.388	1.352	1.452	1.391	1.560	1.363	1.327	1.612	1.274	1.418	1.456	1.494	1.438	1.112	1.390	1.482	1.131	-0.538
1082.6	1.426	1.616	1.177	1.058	1.613	1.421	1.306	1.438	1.249	1.595	1.042	1.497	1.627	1.331	1.432	1.569	1.237	1.229	1.426	1.384	1.574	1.194	-0.164
1083.8	1.438	1.595	0.892	1.162	1.589	1.402	1.467	1.402	1.471	1.615	1.200	1.450	1.573	1.374	1.317	1.690	1.559	1.298	1.260	1.351	1.453	0.543	-0.452
1085.0	1.443	1.604	0.908	1.309	1.680	1.344	1.373	1.318	1.412	1.533	1.199	1.321	1.633	1.322	1.546	1.644	1.346	1.385	1.391	1.293	1.334	1.090	-0.361
1086.2	1.522	1.696	1.271	1.100	1.703	1.404	1.435	1.431	1.435	1.697	1.136	1.432	1.636	1.513	1.312	1.499	1.504	1.342	1.132	1.236	1.641	1.128	-0.292

1087.4	1.524	1.675	1.052	1.251	1.627	1.470	1.414	1.436	1.510	1.544	1.166	1.408	1.568	1.449	1.281	1.590	1.453	1.520	1.226	1.498	1.443	1.192	-0.478
1088.6	1.648	1.723	1.134	1.200	1.627	1.264	1.396	1.235	1.454	1.583	1.312	1.446	1.632	1.482	1.392	1.503	1.494	1.166	1.269	1.369	1.378	0.652	-0.331
1089.8	1.473	1.694	1.018	1.155	1.719	1.631	1.354	1.478	1.493	1.663	1.019	1.503	1.750	1.243	1.325	1.653	1.468	0.758	1.322	1.417	1.625	1.092	-0.169

	269	**271**	**272**	**273**	**274**	**276**	**281**	**282**	**283**	**284**	**286**	**287**	**288**	**291**	**292**	**293**	**296**	**297**	**298**	**299**	**300**	**301**
TP (mg/l)	0.386	0.538	0.807	0.885	0.253	0.278	0.214	0.240	0.197	0.195	0.273	0.138	0.386	0.200	0.126	0.146	0.214	0.181	0.906	0.152	0.848	0.577

APPENDIX D-4

COMBINED BANDS RATIO REGRESSIONS

FEBRUARY 24, 2006-AUGUST 14, 2006

457.34/WL	269	269	271	271	273	273	274	274	281	281	283	283	284	284	287	287	288	288	292	292	293	293	299	299	r
396.3	-2.67	-44.54	-3.10	-41.25	-3.33	-19.02	-3.42	-29.52	-3.72	-1.41	-3.58	-0.95	-3.32	-0.72	-2.98	-1.31	-3.17	-0.84	-3.06	-1.54	-3.04	-1.63	-3.76	-3.02	0.23
406.5	-1.30	-7.08	-1.51	-6.56	-1.62	-3.03	-1.67	-4.69	-1.81	-0.22	-1.75	-0.15	-1.62	-0.12	-1.45	-0.21	-1.54	-0.13	-1.49	-0.24	-1.48	-0.26	-1.83	-0.48	0.05
416.6	-0.88	-9.74	-1.02	-9.02	-1.09	-4.16	-1.12	-6.45	-1.22	-0.31	-1.17	-0.21	-1.09	-0.16	-0.98	-0.29	-1.04	-0.18	-1.00	-0.34	-1.00	-0.36	-1.23	-0.66	0.19
426.8	1.25	4.03	1.49	3.75	1.46	3.46	1.59	3.77	1.50	3.51	1.31	2.18	1.40	1.21	1.35	1.43	1.35	1.59	1.49	1.29	1.77	1.69	1.47	2.31	-0.39
437.0	1.37	1.92	1.25	1.98	1.19	1.90	1.40	1.97	1.38	1.23	1.27	0.47	1.19	0.95	1.40	0.84	1.27	1.49	1.16	0.92	1.15	1.67	1.26	1.36	-0.13
447.2	1.00	1.31	1.02	1.28	1.12	1.34	1.12	1.36	1.04	1.27	1.00	1.09	1.03	-63.00	1.10	1.36	1.18	1.01	1.09	1.84	1.05	1.65	1.17	1.45	0.13
457.3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	####
467.5	0.97	0.82	0.88	0.81	0.99	0.79	0.94	0.83	0.91	0.64	0.95	0.75	0.90	0.36	0.94	0.58	0.95	0.54	0.86	0.60	0.95	0.62	0.93	0.71	0.58
477.7	1.12	0.85	0.96	0.82	1.04	0.80	1.02	0.85	1.01	0.57	1.06	0.41	0.95	0.45	0.97	0.69	1.07	0.37	1.02	0.50	0.97	0.63	0.99	0.67	0.60
487.9	1.20	0.82	1.07	0.82	1.10	0.80	1.14	0.86	1.02	0.63	1.12	0.57	1.04	0.43	1.12	0.70	1.27	0.58	1.11	0.54	1.17	0.62	1.13	0.64	0.62
498.0	1.44	0.83	1.14	0.82	1.26	0.79	1.28	0.85	1.09	0.55	1.15	0.40	1.11	0.48	1.23	0.55	1.31	0.45	1.22	0.50	1.24	0.55	1.12	0.64	0.66
508.2	1.50	0.81	1.16	0.80	1.30	0.78	1.29	0.83	1.20	0.54	1.16	0.47	1.17	0.38	1.36	0.53	1.42	0.40	1.29	0.41	1.36	0.50	1.21	0.62	0.64
518.4	1.70	0.81	1.38	0.80	1.53	0.77	1.44	0.81	1.28	0.65	1.17	0.46	1.22	0.62	1.47	0.59	1.58	0.48	1.36	0.47	1.49	0.54	1.27	0.67	0.71
528.6	1.75	0.80	1.56	0.79	1.66	0.78	1.64	0.81	1.36	0.69	1.33	0.50	1.42	0.53	1.57	0.58	1.76	0.47	1.48	0.52	1.48	0.56	1.29	0.66	0.73
538.7	2.28	0.81	1.77	0.80	1.79	0.79	1.85	0.81	1.35	0.81	1.30	0.70	1.43	0.76	1.73	0.68	1.86	0.52	1.69	0.48	1.77	0.51	1.37	0.77	0.72
548.9	2.37	0.79	1.90	0.79	1.93	0.78	1.95	0.81	1.44	0.94	1.33	0.78	1.56	0.78	2.06	0.85	2.03	0.62	1.96	0.52	1.88	0.55	1.45	0.72	0.70
559.1	2.54	0.79	2.17	0.80	1.89	0.78	2.03	0.82	1.42	0.87	1.32	0.72	1.62	0.82	2.23	0.84	2.37	0.65	2.13	0.45	2.25	0.52	1.53	0.71	0.66
569.3	2.87	0.79	2.33	0.79	2.12	0.78	2.11	0.81	1.50	0.94	1.26	0.79	1.77	1.05	2.33	0.91	2.59	0.62	2.37	0.46	2.55	0.51	1.51	0.69	0.67
579.5	3.91	0.80	2.47	0.79	2.50	0.77	2.33	0.81	1.51	1.01	1.27	0.91	1.79	0.89	2.67	0.95	2.76	0.73	2.47	0.51	2.48	0.52	1.55	0.65	0.69
589.6	3.80	0.80	2.80	0.79	2.67	0.77	2.70	0.81	1.61	0.92	1.38	0.77	1.92	1.11	3.20	0.90	3.30	0.67	2.57	0.51	2.95	0.52	1.60	0.76	0.68
599.8	4.27	0.80	2.82	0.78	2.82	0.77	2.61	0.81	1.64	1.10	1.48	0.97	2.02	1.24	3.30	0.84	3.73	0.95	2.97	0.55	3.22	0.65	1.61	0.70	0.66
610.0	5.64	0.80	3.47	0.80	3.29	0.78	3.28	0.81	2.05	1.76	1.78	1.08	2.34	2.52	4.14	1.09	3.97	0.89	3.57	0.65	4.34	0.72	1.88	0.78	0.61
620.2	9.59	0.81	4.03	0.80	3.96	0.77	3.92	0.83	2.15	1.26	1.92	1.69	2.54	2.74	4.74	1.27	5.18	1.83	3.86	0.67	3.84	0.92	2.17	0.82	0.59
630.3	6.34	0.81	3.98	0.80	4.25	0.77	3.76	0.82	2.25	1.56	1.97	1.43	0.27	12.60	5.82	1.87	5.39	1.66	4.76	0.72	5.59	0.86	2.36	0.80	0.28
640.5	8.24	0.82	4.81	0.81	4.86	0.78	4.74	0.83	2.58	1.95	2.18	1.11	3.10	5.73	7.25	1.65	9.06	1.38	5.40	0.83	5.50	0.97	2.65	0.83	0.56
650.7	29.26	0.80	5.93	0.78	5.60	0.75	5.27	0.81	2.63	2.67	2.10	1.26	3.48	####	7.51	1.43	8.35	1.30	4.80	0.71	6.49	0.92	2.56	0.82	####
660.8	31.70	0.80	5.01	0.78	5.97	0.76	5.67	0.80	2.90	7.69	2.47	4.37	3.71	-1.66	5.93	2.71	10.44	2.92	6.57	0.77	8.77	1.19	3.03	0.92	0.41
671.0	23.25	0.80	7.84	0.80	9.90	0.76	5.80	0.81	3.70	2.86	3.34	1.93	4.81	-6.30	17.22	6.00	13.88	12.17	9.82	1.06	10.71	1.33	3.32	0.96	0.48
681.2	177.50	0.78	8.57	0.77	8.22	0.75	6.52	0.80	3.60	2.73	3.41	1.84	4.73	-31.50	10.44	3.35	11.69	2.35	9.31	0.86	11.61	0.98	3.19	0.94	0.30
691.4	19.36	0.77	7.20	0.77	6.46	0.72	6.25	0.78	3.64	1.66	3.12	1.22	4.13	4.20	9.42	2.38	10.17	1.52	7.83	0.71	8.73	0.84	2.99	0.83	0.55
701.5	-32.27	0.75	10.97	0.74	8.79	0.71	7.45	0.75	3.54	3.84	3.34	1.98	4.67	-4.50	13.63	1.87	14.86	3.04	9.39	0.86	11.86	0.90	2.95	0.84	0.12
711.7	-6.51	0.74	27.10	0.74	140.96	0.72	42.35	0.77	6.69	-3.24	6.48	-1.17	13.16	-0.62	-31.27	-1.44	-14.06	-0.91	-54.84	-44.67	-31.85	35.50	6.27	1.72	0.67
721.9	-12.44	0.69	13.85	0.70	36.40	0.66	27.28	0.71	7.18	-1.48	7.68	-1.43	8.58	-0.79	88.67	-2.07	####	-1.11	30.59	-44.67	90.31	-23.67	6.00	1.71	0.23
732.1	-5.20	0.69	-4.85	0.70	-55.21	0.69	-23.19	0.71	69.92	-1.24	51.70	-0.91	85.77	-0.53	-9.72	-1.02	-11.23	-0.69	-23.59	-2.58	-14.14	-17.75	12.11	2.37	-0.25
742.3	-3.67	0.71	-3.36	0.75	-8.99	0.71	-7.35	0.75	-25.47	-0.93	-23.55	-0.70	-11.45	-0.42	-6.94	-0.86	-6.94	-0.50	-7.20	-1.54	-7.26	-1.39	####	2.99	-0.04
752.4	-3.21	0.71	-6.08	0.75	-6.90	0.72	-6.17	0.76	-14.28	-0.84	-11.75	-0.52	-10.11	-0.35	-5.56	-0.67	-5.72	-0.44	-6.68	-1.21	-5.98	-1.34	-18.71	3.51	-0.40
762.6	-5.26	0.71	-16.39	0.74	-19.26	0.71	-19.82	0.74	20.03	-1.19	23.94	-0.89	-42.88	-0.49	-14.32	-1.21	-20.98	-0.70	-18.22	-13.40	-16.53	-2.33	32.68	2.07	-0.31
772.8	-3.65	0.69	-6.86	0.72	-5.88	0.69	-6.99	0.73	-13.19	-1.03	-12.34	-0.50	-10.40	-0.38	-5.55	-0.73	-5.90	-0.51	-5.69	-1.46	-6.11	-2.06	-25.45	3.93	-0.33

783.0	-3.06	0.70	-5.20	0.74	-6.03	0.70	-6.06	0.74	-12.39	-0.74	-12.03	-0.54	-8.94	-0.32	-4.99	-0.74	-5.85	-0.42	-5.70	-0.96	-5.72	-1.61	-14.04	3.46	-0.42
793.1	-3.01	0.69	-4.52	0.73	-5.63	0.69	-7.78	0.73	-13.43	-0.84	-10.27	-0.64	-8.61	-0.42	-5.31	-0.70	-5.25	-0.40	-6.32	-1.23	-6.13	-1.15	-12.95	2.46	-0.40
803.3	-3.62	0.67	-5.37	0.72	-6.08	0.68	-6.26	0.72	-8.59	-0.91	-18.44	-0.82	-15.11	-0.41	-4.74	-0.71	-6.44	-0.40	-5.39	-1.47	-4.83	-1.53	-25.28	3.42	-0.30
	269	**269**	**271**	**271**	**273**	**273**	**274**	**274**	**281**	**281**	**283**	**283**	**284**	**284**	**287**	**287**	**288**	**288**	**292**	**292**	**293**	**293**	**299**	**299**	
TP (mg/l)	0.39	0.04	0.54	0.06	0.89	0.01	0.25	0.03	0.21	0.03	0.20	0.02	0.20	0.03	0.14	0.06	0.39	0.02	0.13	0.03	0.15	0.02	0.15	0.04	

APPENDIX D-5

COMBINED LOG BANDS RATIO REGRESSIONS

FEBRUARY 24, 2006-AUGUST 14, 2006

487.87/WL																									
	269	**269**	**271**	**271**	**273**	**273**	**274**	**274**	**281**	**281**	**283**	**283**	**284**	**284**	**287**	**287**	**288**	**288**	**292**	**292**	**293**	**293**	**299**	**299**	**r**
396.29	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
406.47	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
416.64	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
426.82	0.017	0.690	0.145	0.660	0.122	0.637	0.144	0.642	0.165	0.744	0.067	0.585	0.129	0.454	0.081	0.306	0.027	0.434	0.128	0.379	0.178	0.437	0.113	0.554	-0.618
436.99	0.058	0.367	0.070	0.384	0.033	0.375	0.088	0.360	0.129	0.288	0.053	-0.081	0.058	0.351	0.097	0.076	0.001	0.407	0.018	0.235	-0.010	0.432	0.046	0.325	-0.517
447.17	-0.081	0.201	-0.019	0.195	0.005	0.226	-0.007	0.199	0.005	0.301	-0.051	0.284	-0.003	#NUM!	-0.006	0.285	-0.032	0.240	-0.008	0.533	-0.049	0.427	0.015	0.351	#NUM!
457.34	-0.079	0.084	-0.028	0.087	-0.043	0.097	-0.058	0.066	-0.011	0.198	-0.050	0.245	-0.016	0.371	-0.048	0.153	-0.104	0.234	-0.047	0.269	-0.070	0.209	-0.054	0.191	-0.591
467.52	-0.093	-0.002	-0.083	-0.004	-0.047	-0.007	-0.086	-0.015	-0.052	0.007	-0.073	0.123	-0.061	-0.068	-0.075	-0.087	-0.128	-0.037	-0.110	0.046	-0.094	0.004	-0.085	0.044	-0.430
477.69	-0.029	0.012	-0.044	0.001	-0.025	0.000	-0.049	-0.004	-0.007	-0.047	-0.023	-0.141	-0.037	0.027	-0.060	-0.008	-0.076	-0.202	-0.037	-0.032	-0.081	0.010	-0.060	0.016	-0.020
487.87	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	#####
498.04	0.078	0.001	0.030	0.000	0.058	-0.003	0.049	-0.005	0.026	-0.062	0.012	-0.154	0.029	0.053	0.041	-0.106	0.012	-0.113	0.040	-0.029	0.022	-0.048	-0.007	-0.003	0.516
508.22	0.096	-0.007	0.037	-0.011	0.070	-0.013	0.051	-0.012	0.069	-0.070	0.014	-0.084	0.053	-0.055	0.085	-0.127	0.049	-0.166	0.064	-0.113	0.064	-0.092	0.029	-0.018	0.579
518.39	0.150	-0.007	0.112	-0.010	0.142	-0.014	0.101	-0.025	0.096	0.009	0.019	-0.089	0.069	0.166	0.118	-0.074	0.096	-0.085	0.087	-0.063	0.103	-0.058	0.048	0.018	0.624
528.57	0.164	-0.011	0.164	-0.015	0.177	-0.010	0.158	-0.023	0.123	0.040	0.072	-0.056	0.135	0.091	0.146	-0.081	0.141	-0.091	0.122	-0.017	0.100	-0.040	0.056	0.009	**0.719**
538.74	0.279	-0.010	0.219	-0.011	0.210	-0.004	0.209	-0.026	0.119	0.106	0.063	0.089	0.139	0.251	0.189	-0.013	0.165	-0.049	0.181	-0.054	0.177	-0.079	0.084	0.075	0.600
548.92	0.295	-0.017	0.250	-0.015	0.242	-0.009	0.233	-0.025	0.149	0.171	0.075	0.135	0.177	0.262	0.266	0.082	0.204	0.025	0.246	-0.019	0.206	-0.053	0.107	0.047	0.575
559.09	0.325	-0.017	0.307	-0.011	0.233	-0.013	0.250	-0.023	0.141	0.136	0.069	0.104	0.193	0.284	0.300	0.079	0.270	0.044	0.282	-0.082	0.283	-0.071	0.131	0.041	0.566
569.27	0.379	-0.016	0.339	-0.015	0.284	-0.011	0.267	-0.023	0.166	0.171	0.050	0.143	0.232	0.392	0.319	0.113	0.310	0.025	0.327	-0.072	0.337	-0.079	0.125	0.027	0.543
579.45	0.513	-0.013	0.364	-0.013	0.354	-0.015	0.310	-0.026	0.169	0.201	0.052	0.205	0.237	0.319	0.379	0.130	0.337	0.097	0.345	-0.025	0.325	-0.073	0.135	0.006	0.601
589.62	0.501	-0.013	0.419	-0.013	0.383	-0.015	0.374	-0.024	0.197	0.161	0.089	0.131	0.266	0.414	0.457	0.106	0.414	0.059	0.363	-0.027	0.400	-0.078	0.149	0.073	0.608
599.80	0.551	-0.014	0.422	-0.019	0.406	-0.019	0.358	-0.027	0.205	0.239	0.121	0.230	0.290	0.463	0.470	0.076	0.468	0.210	0.426	0.009	0.438	0.023	0.152	0.038	0.561
609.97	0.672	-0.011	0.512	-0.011	0.475	-0.012	0.459	-0.024	0.300	0.443	0.200	0.278	0.353	0.772	0.569	0.188	0.495	0.183	0.505	0.080	0.568	0.065	0.220	0.084	0.470
620.15	0.903	-0.005	0.577	-0.012	0.554	-0.018	0.535	-0.016	0.322	0.297	0.233	0.474	0.388	0.809	0.627	0.255	0.610	0.495	0.540	0.097	0.515	0.171	0.282	0.103	0.484
630.32	0.723	-0.005	0.572	-0.009	0.585	-0.016	0.518	-0.022	0.342	0.390	0.245	0.401	-0.581	1.471	0.717	0.424	0.627	0.453	0.631	0.127	0.678	0.144	0.319	0.095	0.244
640.50	0.837	-0.003	0.654	-0.003	0.643	-0.013	0.618	-0.016	0.402	0.488	0.288	0.289	0.476	1.129	0.812	0.371	0.853	0.373	0.686	0.189	0.670	0.197	0.369	0.112	0.455
650.67	1.387	-0.013	0.745	-0.019	0.705	-0.028	0.664	-0.026	0.410	0.625	0.272	0.345	0.525	#####	0.827	0.306	0.818	0.349	0.634	0.122	0.743	0.174	0.354	0.104	#####
660.85	1.422	-0.014	0.672	-0.021	0.733	-0.022	0.696	-0.030	0.451	1.084	0.343	0.886	0.553	#NUM!	0.725	0.586	0.914	0.699	0.770	0.158	0.873	0.286	0.428	0.154	#NUM!
671.02	1.287	-0.012	0.866	-0.013	0.953	-0.022	0.706	-0.027	0.558	0.654	0.473	0.531	0.666	#NUM!	1.188	0.931	1.038	1.319	0.945	0.296	0.960	0.332	0.466	0.174	#NUM!
681.20	2.170	-0.021	0.905	-0.024	0.872	-0.029	0.756	-0.032	0.546	0.635	0.483	0.511	0.659	#NUM!	0.971	0.678	0.964	0.606	0.922	0.206	0.995	0.200	0.449	0.162	#NUM!
691.37	1.208	-0.032	0.829	-0.028	0.767	-0.044	0.738	-0.041	0.550	0.419	0.443	0.332	0.599	0.994	0.926	0.528	0.903	0.416	0.847	0.117	0.871	0.131	0.421	0.112	0.544
701.55	#NUM!	-0.039	1.012	-0.044	0.901	-0.050	0.815	-0.061	0.539	0.783	0.473	0.541	0.653	#NUM!	1.086	0.424	1.068	0.717	0.926	0.206	1.005	0.166	0.416	0.114	#NUM!
711.72	#NUM!	-0.046	1.405	-0.044	2.106	-0.047	1.569	-0.050	0.815	#NUM!	0.761	#NUM!	1.103	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	1.760	0.743	0.426	#NUM!
721.90	#NUM!	-0.077	1.113	-0.070	1.518	-0.081	1.378	-0.084	0.846	#NUM!	0.835	#NUM!	0.917	#NUM!	1.900	#NUM!	3.696	#NUM!	1.439	#NUM!	1.886	#NUM!	0.724	0.423	#NUM!
732.07	#NUM!	-0.079	#NUM!	-0.067	#NUM!	-0.067	#NUM!	-0.084	1.834	#NUM!	1.663	#NUM!	1.917	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	1.029	0.565	#NUM!
742.25	#NUM!	-0.063	#NUM!	-0.039	#NUM!	-0.049	#NUM!	-0.057	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.666	#NUM!
752.43	#NUM!	-0.066	#NUM!	-0.036	#NUM!	-0.044	#NUM!	-0.053	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.736	#NUM!
762.60	#NUM!	-0.066	#NUM!	-0.041	#NUM!	-0.053	#NUM!	-0.064	1.291	#NUM!	1.329	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	1.460	0.507	#NUM!
772.78	#NUM!	-0.076	#NUM!	-0.057	#NUM!	-0.061	#NUM!	-0.072	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.785	#NUM!
782.95	#NUM!	-0.072	#NUM!	-0.043	#NUM!	-0.056	#NUM!	-0.063	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.730	#NUM!
793.13	#NUM!	-0.078	#NUM!	-0.049	#NUM!	-0.064	#NUM!	-0.070	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.581	#NUM!
803.30	#NUM!	-0.092	#NUM!	-0.058	#NUM!	-0.068	#NUM!	-0.079	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.724	#NUM!
	269	**269**	**271**	**271**	**273**	**273**	**274**	**274**	**281**	**281**	**283**	**283**	**284**	**284**	**287**	**287**	**288**	**288**	**292**	**292**	**293**	**293**	**299**	**299**	
TP (mg/l)	0.386	0.037	0.538	0.057	0.885	0.011	0.253	0.031	0.214	0.029	0.197	0.022	0.195	0.034	0.138	0.057	0.386	0.020	0.126	0.030	0.146	0.017	0.152	0.036	

APPENDIX E

FIELD REMOTE SENSING REFLECTANCES CALCULATIONS

STATION NUMBER 266

APPENDIX E-1

FEBRUARY 24, 2006

Wavelength (nm)	L_w	L_s	E_d	R_{rs}
107.95	0	0.01	0.04	-0.00111
115.33	0.016667	0.036667	0.226667	0.010982
122.58	0.02	0.04	0.243333	0.012349
129.71	0.02	0.04	0.263333	0.011411
136.72	0.02	0.05	0.276667	0.0107
143.6	0.023333	0.05	0.303333	0.011508
150.37	0.02	0.05	0.31	0.009549
157.02	0.026667	0.05	0.32	0.012567
163.55	0.03	0.06	0.346667	0.013002
169.97	0.03	0.06	0.353333	0.012756
176.28	0.03	0.06	0.373333	0.012073
182.48	0.03	0.066667	0.386667	0.01158
188.57	0.03	0.066667	0.41	0.010921
194.55	0.033333	0.07	0.426667	0.011703
200.43	0.036667	0.07	0.43	0.012846
206.21	0.036667	0.076667	0.45	0.012209
211.88	0.036667	0.08	0.46	0.011911
217.46	0.036667	0.08	0.493333	0.011106
222.94	0.04	0.086667	0.5	0.01196
228.33	0.04	0.086667	0.52	0.0115
233.62	0.046667	0.09	0.536667	0.013092
238.82	0.046667	0.093333	0.543333	0.012904
243.92	0.046667	0.1	0.566667	0.01232
248.94	0.046667	0.106667	0.576667	0.012055
253.87	0.066667	0.146667	0.816667	0.012192
258.72	0.086667	0.2	1.123333	0.011486
263.48	0.15	0.326667	1.816667	0.01234
268.16	0.216667	0.5	2.696667	0.011961
272.75	0.32	0.723333	3.983333	0.011976
277.27	0.43	1.016667	5.363333	0.011915
281.71	0.856667	2.016667	11.03333	0.011543
286.07	1.756667	4.393333	22.06333	0.011784
290.36	2.73	7.01	34.13667	0.011815
294.57	3.873333	10.62667	49.47333	0.011503
298.71	5.293333	14.82667	65.78667	0.011802
302.78	11.94	36.77333	153.02	0.011348
306.78	22.09667	73.46667	284.86	0.011196
310.71	33.61	123.17	444.0267	0.010811
314.57	49.86333	194.6	654.3833	0.010802
318.37	68.24333	291.8733	894.9833	0.010682
322.1	115.0667	531.8133	1512.88	0.010539
325.77	196.79	971.74	2566.9	0.010515
329.38	302.53	1555.217	3884.433	0.010611
332.93	524.7833	2808.02	6695.567	0.010605
336.42	797.0667	4401.313	10173.23	0.010542
339.85	1086.713	6029.163	13702.5	0.010661
343.22	1349.65	7503.277	16957.96	0.010695
346.53	1627.597	9075.777	20350.98	0.010741
349.79	1900.23	10616.4	23659.79	0.010783
353	2209.64	12240.52	27420.65	0.010836
356.16	2425.96	13283.14	29968.69	0.010908
359.26	2616.343	14272.92	32619.11	0.010816
362.32	2856.713	15561.93	35860.92	0.010745
365.32	3206.247	17337.37	40336.72	0.010735
368.28	3595.293	19139.1	44754.27	0.01088
371.19	3970.22	20970.58	49435.07	0.010892
374.05	4365.603	22740.57	54189.83	0.010952
376.87	4724.207	24143.5	58311.05	0.011049
379.64	5020.49	25570.72	62970.77	0.010879
382.37	5601.03	28396.65	71297.43	0.010728
385.06	6528.513	32655.13	82683.04	0.010807
387.71	7531.677	37420.63	95670.26	0.010786
390.32	8578.683	41806.99	107887.7	0.010928
392.89	9435.52	45305.92	118009.5	0.011014
395.42	9947.987	47036.81	124095	0.011069
397.92	10311.71	48057.79	128456.1	0.011109
400.37	10666.55	49038.04	133362.5	0.011091
402.8	11190.16	50666.98	139790.7	0.011125
405.18	11713.87	52246.94	146398.4	0.011144
407.54	12178.13	53601.81	152555.1	0.011139
409.86	12616.33	54586.41	157776.4	0.011185
412.15	12959.81	55353.5	162491.7	0.011176
414.4	13222.21	55620.03	165952.7	0.011187
416.63	13404.72	55567.8	168538.6	0.011189
418.83	13600.32	55590.62	171366.8	0.011186
420.99	13734.83	55333.19	173230.1	0.011195
423.13	13868.04	55001.22	174940.2	0.011216
425.25	13934.01	54438.78	175840	0.011232
427.33	13952.47	53566.05	175996.7	0.011261
429.39	13805.41	52256.43	174207.9	0.011276
431.43	13701.77	51178.45	173699.1	0.011241
433.44	14132.26	51823.15	179193.5	0.011263
435.42	14987.8	54047.95	189949.4	0.01129
437.38	15806.63	56144.29	199987.8	0.011328
439.32	16290.22	57068.82	205936	0.011355
441.24	16572.34	57283.61	209689.6	0.011361
443.14	16878.24	57450.6	213571.6	0.011379
445.02	17479.32	58422.65	220702.9	0.011425
446.87	18119.6	59670.52	228737.4	0.011445
448.71	18488.79	60076.78	233504.7	0.011455
450.53	18772.92	60067.25	237025.1	0.011476

452.33	19257.72	60580.2	242879.2	0.011508	527.94	20939.09	31516.3	238859.5	0.013364
454.11	19821.24	61381.31	249813.1	0.011533	529.37	21293.88	31353.76	240367.1	0.013518
455.88	20176.24	61681.51	254349.6	0.011544	530.81	21479.68	31364.14	243292.6	0.013477
457.63	20160.96	60868.76	254614	0.011537	532.24	21406.73	31089.26	243426	0.013427
459.36	20185.23	60032.06	254866.6	0.011555	533.67	21348.64	30579	242258.1	0.013463
461.08	20487.4	59832.41	257984.1	0.011606	535.11	21465.67	30267.07	242518.3	0.013531
462.78	20747.25	59734.05	261020.1	0.011631	536.55	21576.46	29936.18	242578.5	0.013606
464.47	20806.27	59091.23	261488.1	0.011657	537.98	21566.75	29494.26	241589.2	0.013664
466.15	20946.3	58559.49	262677	0.011698	539.42	21394.05	28889.44	239516.4	0.013679
467.81	21113.92	58111.57	264230.3	0.011738	540.86	21387.79	28472.75	238839.3	0.013721
469.46	21024.9	57097.68	263112.1	0.011751	542.3	21557.45	28219.66	239741.4	0.013787
471.1	20861.48	55776.7	260430.9	0.011794	543.74	21782.8	28035.31	240878	0.013874
472.72	20796.09	54651.93	258835.4	0.011846	545.18	21990.07	27761.16	241007	0.014008
474.33	20838.61	53842.01	258898.1	0.011884	546.62	22133.14	27428.15	240689	0.014128
475.94	20897.07	53131.15	259332.1	0.011912	548.07	22251.46	27123.62	240655.5	0.014214
477.53	21115.01	52745.75	261351.2	0.011959	549.51	22329.67	26815.07	240363.4	0.014288
479.11	21326.61	52439.89	263783.2	0.011982	550.96	22383.88	26446.14	239538.3	0.01438
480.68	21395.83	51878.76	264733.5	0.01199	552.41	22423.43	26111.33	238944.4	0.014449
482.24	21443.85	51192.4	264986.4	0.012019	553.86	22336.65	25678.52	237290.9	0.014499
483.8	21529.1	50615.87	265709.7	0.012047	555.32	22182.89	25131.27	234610.2	0.014571
485.34	21550.17	50056.91	266285.9	0.012042	556.77	22108.73	24633.22	232521.2	0.014661
486.88	21487.1	49332.12	265425.3	0.012056	558.23	22228.59	24331.53	232234.1	0.014767
488.41	21167.33	48114.48	262159.5	0.012033	559.69	22381.08	24092.6	232597	0.014853
489.93	20481.74	46109.62	254106.3	0.01202	561.16	22424.89	23801.97	232077.5	0.014922
491.45	19960.23	44122.79	246775.7	0.012076	562.62	22382.09	23412.51	230966.6	0.014971
492.95	20306.33	43818.16	248899.4	0.0122	564.09	22373.79	23075.04	230344.8	0.015013
494.46	20763.91	44305	254939.5	0.012188	565.56	22280.14	22718.67	229462.8	0.015012
495.95	20750.51	43905.08	255549.6	0.012158	567.03	22112.5	22346.99	228463	0.014968
497.44	20700.41	43193.3	254507.3	0.012189	568.51	22051.74	22130.04	228859.4	0.014904
498.93	20853.26	42764.72	255353.1	0.012251	569.99	22190.45	21996.66	230123.5	0.014921
500.41	20879.17	42236.25	255389.8	0.012275	571.47	22314.62	21790.51	230259.2	0.015002
501.88	20716.01	41326.04	253003.1	0.012304	572.95	22340.75	21534.72	229937.8	0.015046
503.35	20495.04	40272.39	250141.6	0.012323	574.44	22353.17	21338.62	230077.3	0.015049
504.82	20287.01	39230.03	247035	0.012362	575.93	22398.39	21179.62	230607.7	0.015049
506.28	20330.85	38601.97	246698.1	0.012419	577.42	22422.4	21053.87	231212.9	0.015029
507.74	20506.26	38278.07	247985.3	0.012473	578.92	22346.9	20830.06	231193	0.014982
509.2	20770.88	38147.42	250316.9	0.012527	580.42	22131.97	20504.04	229701.3	0.014937
510.65	20768.57	37602.55	249693.8	0.012567	581.92	21761.08	20050.87	227192.3	0.014851
512.1	20712.55	36967.93	248260.7	0.012615	583.42	21144.66	19425.37	222943.1	0.014706
513.55	20668.9	36408.51	247548.1	0.012633	584.93	20624.36	18864.11	219376.7	0.01458
514.99	20475.06	35725.38	245438.9	0.012628	586.44	20550.47	18636.51	219555.4	0.014519
516.44	20123.08	34814.77	241951.9	0.012596	587.95	20494.41	18627.24	221421.2	0.014356
517.88	19815.06	33842.79	237569.1	0.01264	589.47	20281.88	18522.94	221970.7	0.01417
519.32	19478.01	32720.22	232476.5	0.012708	590.99	20056.91	18414.15	222580.7	0.013973
520.76	19721.86	32320.92	232494.8	0.012881	592.51	19775.14	18315.41	223004.8	0.013747
522.2	20294.5	32605.19	237249.5	0.013002	594.03	19581.13	18187.57	223075.2	0.013607
523.63	20634.12	32702.47	240335.2	0.013058	595.56	19467.82	18044.03	223004.7	0.013533
525.07	20872.8	32535.6	241657.5	0.013147	597.09	19395.85	17931.99	223341.1	0.013464
526.5	20919.36	32148.2	241174.1	0.013215	598.62	19333.64	17826.61	224046.7	0.013379

600.16	19253.23	17690.79	224152.3	0.013319	678.32	15365.25	10619.52	204256.1	0.011741
601.7	19091.79	17483.88	223491.5	0.013247	679.95	14979.36	10255.06	198945.6	0.011754
603.24	18909.27	17240.09	222330.9	0.013191	681.58	14255.07	9665.27	189377.6	0.011753
604.79	18675.37	16979.2	221115.3	0.0131	683.22	13625.94	9080.74	180973.4	0.01176
606.34	18423.89	16757.89	220091.5	0.012984	684.85	13597.5	8921.2	179967.8	0.011804
607.89	18236.02	16544.29	219102.6	0.01291	686.48	13871.6	9046.043	183593.7	0.011806
609.44	18198.05	16320.74	218427.3	0.012927	688.12	13970.84	9123.317	185949.4	0.011739
611	18279.91	16155.62	218005.8	0.013015	689.75	13951.34	9107.673	186985.9	0.011658
612.56	18388.1	16042.67	218589.5	0.013061	691.38	13993.08	9162.243	188709.3	0.011585
614.12	18375.45	15950.9	219117.6	0.013023	693.02	14065.82	9235.437	190523.8	0.011534
615.69	18217.5	15751.7	218330.7	0.012958	694.65	13923.29	9190.417	190082.1	0.011442
617.25	18001.65	15515.48	217002.8	0.012884	696.29	13638.82	9031.363	188352.1	0.011311
618.82	17855.67	15243.39	215457	0.012874	697.92	13468.07	8954.68	187555.5	0.011216
620.4	17731.34	15036.67	214618.4	0.012837	699.55	13460.11	8969.117	188828.7	0.011133
621.97	17599.54	14828.09	213682.9	0.012799	701.19	13478.4	9017.963	190421.5	0.011054
623.55	17470.33	14657.09	212941.4	0.012751	702.82	13444.94	9056.293	191616	0.010957
625.13	17435.84	14521.7	212905.3	0.01273	704.45	13366.67	9052.8	192203.1	0.010858
626.71	17481.4	14448.27	213433.9	0.012734	706.08	13265.64	9019.97	192294.8	0.01077
628.3	17537.04	14376.92	213980.4	0.012744	707.71	13105.8	8968.587	191969.8	0.010657
629.89	17491.55	14265.67	213759.1	0.012726	709.34	12890.32	8840.437	190545.5	0.01056
631.47	17447.33	14135.12	213348.1	0.01272	710.97	12475.97	8589.34	186292.2	0.010453
633.07	17459.51	14030.81	213404.3	0.012728	712.6	11678.38	8069.41	176591.2	0.010322
634.66	17450.65	13905.73	213231.6	0.012734	714.23	10595.72	7295.377	162510.3	0.010177
636.26	17494.76	13759.05	212748.3	0.012799	715.86	9841.933	6729.51	152799.5	0.010055
637.86	17386.84	13595.18	212100.7	0.012761	717.49	9939.35	6710.55	153510.2	0.01011
639.46	17087.12	13377.59	210825.4	0.012617	719.11	10293.52	6980.783	158907.2	0.010114
641.06	16677.92	13110.62	208929.1	0.012425	720.74	10256.78	6985.993	159357.1	0.010048
642.66	16337.98	12863.97	207266.7	0.012269	722.36	9950.83	6801.423	155941.6	0.009962
644.27	16055.12	12712.36	206503.7	0.0121	723.99	9860.913	6706.753	155103.2	0.009926
645.88	15935.41	12577.34	206129.2	0.012032	725.61	9864.34	6717.453	155479.3	0.009905
647.49	16086.23	12419.61	204928.3	0.012223	727.23	9959.563	6767.713	157214.3	0.009891
649.1	16139.38	12123.58	201641.7	0.012471	728.85	10227.09	6987.66	161774.8	0.009869
650.71	16018.53	11874.84	199165.1	0.012535	730.47	10620.49	7309.703	168323.7	0.009848
652.32	16174.07	11864.24	200956.3	0.012544	732.08	10937.31	7575.613	173617.2	0.009832
653.94	16437.71	12021.65	205446.8	0.012473	733.7	11053.79	7691.493	175958.8	0.009803
655.56	16377.14	12091.26	208243	0.012258	735.32	11065.65	7748.317	176861.2	0.009763
657.18	16291.32	12070.69	209539.1	0.012111	736.93	11094.47	7780.69	177593.8	0.009747
658.8	16248.63	11985.56	209669.2	0.012079	738.54	11145.6	7828.15	178557	0.009739
660.42	16231.13	11883.55	209681.5	0.012067	740.15	11253.99	7905.56	180072.7	0.009751
662.04	16102.81	11768.6	209362	0.011991	741.76	11328.21	7938.747	181575.8	0.009735
663.66	15880.58	11660.56	208914.7	0.011849	743.37	11383.15	8002.947	182354.9	0.009739
665.29	15648.58	11552.49	208498	0.011693	744.97	11399.29	7958.477	182629	0.00974
666.92	15519.54	11427.88	208151.4	0.011622	746.58	11364.87	7915.153	182071.5	0.009741
668.54	15479.17	11368.25	208316.7	0.011583	748.18	11286.81	7843.083	181330.3	0.009714
670.17	15498.22	11260.22	208377.6	0.011596	749.78	11231.37	7784.333	180600.3	0.009706
671.8	15526.9	11179.26	208241.8	0.011628	751.38	11201.12	7730.41	180148.7	0.009705
673.43	15537.99	11080.49	208017.2	0.011651	752.98	11169.58	7677.293	179842.7	0.009694
675.06	15535.59	10969.28	207562.9	0.011677	754.57	11045.29	7539.143	177787.9	0.009699
676.69	15494.56	10835.75	206536.7	0.011706	756.16	10405.43	7085.817	167472.8	0.0097

757.76	8606.163	5952.747	141482.7	0.009494	833.23	8452.337	4535.663	138284.2	0.009582
759.35	6564.683	4529.093	111045.4	0.009227	834.72	8667.877	4693.987	141599.5	0.009595
760.93	5721.747	3813.24	97336.51	0.009181	836.21	8861.21	4766.347	144446.7	0.009616
762.52	6314.087	3983.757	103906	0.009501	837.7	8978.783	4858.02	146662.2	0.009596
764.1	7381.733	4620.38	119802.3	0.009635	839.18	9062.87	4910.88	148444.7	0.009569
765.69	8683.49	5443	139788.9	0.009713	840.67	9127.417	4966.36	149375.2	0.009577
767.27	9737.593	6214.85	156741.9	0.009711	842.15	9118.973	4935.063	149842.2	0.009539
768.85	10307.84	6664.743	166471.9	0.009676	843.63	9118.853	4964.073	149855.6	0.009537
770.42	10539.04	6893.737	171112.5	0.009623	845.11	9125.23	4971.437	150621.4	0.009495
772	10611.03	6959.873	172923.8	0.009587	846.59	9101.583	4965.78	150180.6	0.009498
773.57	10643.3	6957.29	173537.1	0.009583	848.07	8965.05	4882.06	148284.1	0.009476
775.14	10648.97	6957.76	173702.1	0.009579	849.54	8772.02	4766.91	145802.6	0.00943
776.7	10632.33	6907.317	173772.3	0.009561	851.02	8663.093	4733.497	144196	0.009416
778.27	10618.46	6862.363	173633	0.009557	852.49	8446.853	4593.287	141101.4	0.009383
779.83	10615.91	6831.203	173375.8	0.00957	853.96	8286.793	4533.9	139188.1	0.00933
781.4	10592.84	6795.053	173134.3	0.009563	855.43	8470.197	4562.377	142198.8	0.009337
782.96	10545.22	6730.137	172537.2	0.009553	856.9	8734.7	4702.963	145842.1	0.009388
784.51	10489.9	6657.687	171742.3	0.009548	858.37	8767.57	4703.157	147132.5	0.009342
786.07	10413.75	6545.94	170363.6	0.009557	859.83	8767.693	4713.86	147185.3	0.009338
787.62	10260.37	6422.34	168355.9	0.00953	861.3	8753.783	4714.003	147237.5	0.00932
789.17	10113.83	6294.043	166222.4	0.009515	862.76	8691.703	4652.023	145640	0.009356
790.72	10015.18	6198.613	164373.5	0.009523	864.23	8447.297	4548.63	142142.5	0.009316
792.27	9964.693	6137.183	163729.5	0.009519	865.69	8270.02	4435.33	139278.5	0.009308
793.81	9942.757	6121.483	163164.1	0.009531	867.15	8422.593	4515.023	140781.5	0.009379
795.35	9931.703	6081.74	163126	0.009524	868.62	8601.847	4547.607	142895	0.009439
796.89	9945.993	6021.507	163174.5	0.009537	870.08	8658.727	4540.157	143858.1	0.009439
798.43	9944.97	5999.433	163126.7	0.009539	871.54	8653.47	4540.76	143781.4	0.009438
799.97	9860.907	5915.54	162076.2	0.009521	873	8623.35	4495.68	142622.1	0.009483
801.5	9787.387	5862.767	160954.9	0.009516	874.46	8619.46	4452.633	142467.1	0.00949
803.03	9761.58	5827.353	160553.2	0.009515	875.91	8636.923	4460.13	142327.7	0.009518
804.56	9775.983	5787.17	160879.2	0.009511	877.37	8606.123	4422.307	141487.9	0.009541
806.09	9816.837	5807.623	161243.8	0.009529	878.83	8544.867	4413.333	140585	0.009534
807.61	9776.437	5743.743	160166.6	0.009555	880.29	8520.767	4369.51	139946.6	0.009551
809.14	9636.697	5589.847	158027.5	0.009548	881.74	8536.27	4322.55	140282.8	0.009547
810.66	9387.19	5416.607	154018.2	0.009544	883.2	8507.2	4292.977	139398.7	0.009576
812.17	8954.113	5123.973	147531.9	0.009505	884.66	8422.617	4274.667	138457.9	0.009544
813.69	8364.007	4712.093	138118.4	0.009486	886.11	8384.74	4219.577	137838	0.009545
815.21	7823.507	4388.117	129717.3	0.009448	887.57	8397.607	4215.46	137835.1	0.00956
816.72	7590.857	4217.767	125995.2	0.009433	889.03	8312.017	4185.707	136337.1	0.009566
818.23	7677.267	4228.603	126561.7	0.009505	890.48	8091.83	4034.673	132829.6	0.00956
819.74	7975.63	4369.193	130190.5	0.00966	891.94	7668.563	3792.793	126766.4	0.009495
821.25	8022.883	4356.753	130822.4	0.009612	893.39	7107.603	3505.923	118563.2	0.009409
822.75	7876.157	4305.713	128929.4	0.009574	894.85	6543.277	3191.72	109617.3	0.009371
824.25	8067.887	4397.267	131948.6	0.009583	896.31	6062.493	2944.567	102476	0.009288
825.75	8403.867	4540.817	136221.1	0.00967	897.76	5810.237	2822.377	98321.84	0.009277
827.25	8369.353	4547.28	136269.2	0.009626	899.22	5840.167	2866.797	98781.93	0.00928
828.75	8243.623	4447.123	134788.8	0.009587	900.68	6229.52	2921.62	103665.8	0.009438
830.25	8263.293	4474.617	135354.6	0.009569	902.14	6699.99	3123.327	110437.2	0.00953
831.74	8335.77	4497.33	136352.6	0.009583	903.59	6705.427	3123.31	110262	0.009553

905.05	6200.537	2941.543	103856.8	0.009376	977.9	5524.417	2525.893	94403.24	0.009194
906.51	5790.187	2829.363	98594.53	0.009219	979.42	5735.263	2638.537	97768.08	0.009216
907.97	5740.097	2695.457	96509.54	0.009342	980.94	6013.47	2775.45	101138.9	0.009341
909.43	5767.37	2700.42	96513.42	0.009386	982.47	6115.487	2756.28	104016.6	0.009239
910.89	5655.987	2624.277	95166.9	0.009336	983.99	6316.973	2972.2	107267.1	0.009249
912.35	5505.393	2540.443	93088.25	0.009291	985.52	6464.57	3027.063	108905.8	0.009323
913.82	5512.18	2520.24	93006.24	0.009312	987.05	6496.44	2983.55	110977.5	0.009197
915.28	5652.407	2639.633	94930.03	0.009353	988.58	6543.273	3206.693	111929.9	0.009176
916.74	5937.61	2742.07	99649.86	0.009361	990.11	6644.393	3170.977	112285.6	0.009292
918.21	6269.663	2875.56	104129.3	0.00946	991.64	6666.717	3128.413	113602.8	0.009217
919.68	6272.14	2855.37	104518.3	0.009429	993.17	6662.093	3205.53	114974.2	0.009098
921.14	6131.433	2819.927	102767.2	0.009373	994.71	6749.007	3233.177	115085.2	0.009208
922.61	6025.313	2768.913	101334.5	0.009342	996.24	6736.73	3149.243	115125.8	0.009191
924.08	5771.337	2694.087	97945.07	0.009256	997.77	6678.443	3121.16	115388.4	0.009091
925.55	5224.983	2457.85	88859.56	0.009235	999.31	6685.45	3172.757	114694	0.009154
927.02	4306.493	2057.713	74967.86	0.00902	1000.85	6645.06	3160.593	114808.8	0.009089
928.49	3421.357	1672.95	61674.95	0.008718	1002.38	6588.713	3219.353	113773.6	0.009091
929.97	2646.643	1304.467	49001.72	0.008478	1003.92	6606.71	3166.463	111897.5	0.009271
931.44	2174.01	1123.54	41032.11	0.008311	1005.45	6655.11	3182.61	113192.4	0.009232
932.92	2100.073	1123.783	38358.5	0.008583	1006.99	6684.693	3205.077	112267.1	0.009349
934.4	2229.627	1096.85	40272.22	0.00869	1008.53	6681.673	3278.05	115154.8	0.009108
935.88	2612.177	1155.01	45752.04	0.008974	1010.06	6736.85	3241.38	114602	0.00923
937.36	3078.933	1371.163	52153.75	0.009279	1011.6	6740.55	3352.447	115723.5	0.009141
938.84	3133.093	1377.957	53790.65	0.009156	1013.13	6721.62	3360.81	115422.4	0.009139
940.32	2849.817	1256.287	50436.87	0.008882	1014.67	6781.51	3479.27	114846.9	0.009263
941.81	2689.877	1229.353	48522.81	0.00871	1016.2	6893.297	3246.727	115346.8	0.009386
943.29	2654.617	1292.45	47343.38	0.008802	1017.74	6737.08	3335.19	115797.8	0.009131
944.78	2712.553	1255.307	48443.92	0.008796	1019.27	6868.027	3277.923	115438.4	0.009342
946.27	2859.157	1328.16	49947.75	0.008992	1020.8	6732.873	3181.17	115028.2	0.009192
947.76	2927.983	1366.58	50597.32	0.00909	1022.33	6834.537	3473.91	113657.2	0.009434
949.25	2952.687	1288.03	51268.07	0.009054	1023.86	6755.86	3358.293	114849.7	0.009232
950.74	2945.22	1338.203	51938.72	0.00891	1025.39	6649.61	3432.717	116671.3	0.00894
952.24	3004.64	1394.057	52297.94	0.009025	1026.91	6908.347	3507.64	116436.6	0.009309
953.74	3094.133	1391.91	54085.61	0.00899	1028.44	6797.463	3460.117	115902.9	0.009201
955.23	3274.683	1470.39	56316	0.009138	1029.96	6856.863	3551.083	117372.7	0.009163
956.73	3313.813	1470.737	57911.06	0.008994	1031.48	6931.863	3221.853	117353.5	0.009279
958.24	3490.383	1543.58	60054.8	0.009136	1033	6824.383	3418.57	115619.1	0.009262
959.74	3682.977	1694.427	63838.28	0.009064	1034.51	6971.68	3858.377	118252.5	0.009238
961.24	3907.07	1763.857	67000.59	0.009164	1036.02	6957.917	3562.457	117449.7	0.009293
962.75	4098.06	1901.027	70041.96	0.009191	1037.53	6780.72	3920.33	118829.6	0.008935
964.26	4445.513	2045.603	75299.65	0.009275	1039.03	6913.173	3707.283	118025.4	0.009182
965.77	4963.407	2226.26	84313.64	0.009252	1040.54	7122.5	3919.767	115107.3	0.009696
967.28	5351.487	2414.36	91071.59	0.009234	1042.03	7118.253	3915.873	118936.2	0.009379
968.79	5556.143	2469.393	94171.87	0.009273	1043.53	7137.387	3577.377	119199.6	0.009396
970.3	5463.757	2418.093	93461.75	0.009189	1045.02	7041.413	3457.023	119649.4	0.009238
971.82	5148.827	2411.933	89862.55	0.008999	1046.5	7151.863	3642.327	121714.5	0.009218
973.34	5089.447	2382.923	88668.15	0.009016	1047.98	7164.45	4037.427	118589.4	0.009463
974.85	5220.417	2384.127	90671.61	0.009046	1049.46	7137.163	4220.233	117835.6	0.00948
976.37	5362.037	2470.11	92055.32	0.009151	1050.93	7207.66	3452.773	124299.8	0.009105

1052.39	7084.05	3913.093	120721.2	0.009195	1073.48	7601.593	4773.95	134258.1	0.008853
1053.85	7416.793	4629.59	120369.4	0.009635	1074.82	8129.177	4561.17	127124.2	0.010018
1055.3	7429.583	4133.013	125171.3	0.0093	1076.14	7681.97	5096.69	122616	0.009786
1056.75	7177.747	3780.45	121996.1	0.009226	1077.44	7787.483	4227.49	131126.4	0.009308
1058.19	7366.88	4339.767	123656.5	0.009325	1078.74	7857.393	5112.943	127823.6	0.009605
1059.62	7649.687	4212.87	123947.1	0.00967	1080.02	7968.603	5516.727	135159.8	0.009201
1061.05	7371.457	4312.153	123537.5	0.009341	1081.3	8280.283	5597.94	133417.6	0.009691
1062.46	6978.29	4570.933	126523.4	0.008617	1082.55	8544.187	5063.22	124681.8	0.010726
1063.87	7857.243	4580.74	128006.2	0.0096	1083.79	8611.403	6397.04	132533.6	0.010126
1065.27	7521.173	5168.737	129351	0.009076	1085.02	8124.697	5360.62	131670.3	0.009639
1066.67	7337.95	4348.413	130180.7	0.008812	1086.24	8198.167	6213.35	129099.5	0.009892
1068.05	8068.677	5147.26	128820.6	0.00979	1087.43	8969.567	4730.22	129590.2	0.010853
1069.42	7909.01	4773.907	131674.3	0.009398	1088.62	9398.187	4791.23	133048.8	0.011082
1070.79	7652.073	4981.067	131095.9	0.00912	1089.78	8575.187	5557.103	134903.5	0.009933
1072.14	7608.783	4368.68	124944.2	0.009536					

APPENDIX E-2

MAY 12, 2006

Wavelength (nm)	L_w	L_s	E_d	R_{rs}
107.95	0	0.01	0.03	-0.058643
115.33	0	0.0966667	0.19	-0.089508
122.58	0.0033333	0.1033333	0.2066667	0.0133771
129.71	0.0066667	0.11	0.22	0.102435
136.72	0.01	0.12	0.23	0.1813928
143.6	0.01	0.13	0.25	0.1598442
150.37	0.01	0.1333333	0.26	0.1514409
157.02	0.01	0.14	0.27	0.141488
163.55	0.01	0.1466667	0.29	0.1276859
169.97	0.01	0.1533333	0.3	0.1195201
176.28	0.01	0.1633333	0.31	0.1099895
182.48	0.01	0.17	0.3266667	0.1007874
188.57	0.01	0.18	0.34	0.0916606
194.55	0.01	0.1833333	0.35	0.0873662
200.43	0.01	0.1933333	0.36	0.0800524
206.21	0.01	0.2	0.3733333	0.0740518
211.88	0.01	0.2066667	0.4	0.0661829
217.46	0.01	0.2133333	0.4033333	0.062728
222.94	0.01	0.2233333	0.42	0.05605
228.33	0.01	0.23	0.4366667	0.0512247
233.62	0.01	0.2366667	0.4466667	0.0474521
238.82	0.01	0.25	0.4633333	0.0406825
243.92	0.01	0.2533333	0.47	0.0388577
248.94	0.01	0.2633333	0.4933333	0.0334537
253.87	0.02	0.37	0.6866667	0.0882086
258.72	0.02	0.51	0.9433333	0.0380987
263.48	0.04	0.8233333	1.5133333	0.0703606
268.16	0.06	1.24	2.27	0.0699731
272.75	0.08	1.8	3.2933333	0.0564724
277.27	0.1133333	2.4933333	4.4766667	0.0610821
281.71	0.2233333	4.98	8.8866667	0.0593155
286.07	0.49	10.63	18.526667	0.0652375
290.36	0.75	16.616667	28.72	0.0622922
294.57	1.08	24.576667	41.51	0.0593131
298.71	1.45	33.57	55.02	0.0582457
302.78	3.4033333	81.05	127.79333	0.0557518
306.78	6.41	157.01667	237.87333	0.0531855
310.71	9.9066667	251.62333	365.06333	0.049245
314.57	14.616667	385.85333	535.57667	0.04473
318.37	20.173333	558.61333	739.13667	0.0385266
322.1	34.83	990.7	1252.82	0.03556
325.77	60.003333	1760.42	2136.71	0.0314983
329.38	90.856667	2761.4067	3198.1733	0.0265956
332.93	157.53	4899.9033	5549.3567	0.0230214
336.42	239.85667	7613.91	8390.16	0.0199704
339.85	322.96333	10383.64	11289.617	0.0179327
343.22	397.4	12911.097	13919.46	0.0162003
346.53	474.95667	15613.06	16770.183	0.0141589
349.79	555.28667	18276.273	19539.35	0.0140045
353	642.73	21087.957	22527.203	0.0145781
356.16	699.98667	23028.427	24651.793	0.0140669
359.26	759.25	24872.69	26824.18	0.0147135
362.32	834.15667	27290.787	29646.903	0.0148385
365.32	933.99	30490.963	33312.627	0.0151349
368.28	1032.5367	33751.557	36873.947	0.0149085
371.19	1136.2167	37164.147	40730.18	0.0147508
374.05	1239.9667	40531.99	44643.06	0.014788
376.87	1327.8433	43317.72	48074.27	0.0150233
379.64	1431.5567	46224.643	51901.823	0.0166174
382.37	1608.4833	51659.777	58810.853	0.0173086
385.06	1861.1233	59640.56	68402.42	0.0175618
387.71	2142.1067	68680.127	79118.627	0.0173968
390.32	2406.65	77144.153	89037.57	0.017403
392.89	2634.3033	84034.59	97284.347	0.0181702
395.42	2763.0167	87824.353	102253.06	0.018676
397.92	2861.1567	90312.537	106122.89	0.0196806
400.37	2960.95	92745.6	110022.35	0.0207916
402.8	3101.5333	96521.533	115547.26	0.0216929
405.18	3237.9033	100223.87	121030.06	0.022408
407.54	3367.2433	103542.57	126167.56	0.0233091
409.86	3478.87	106274.05	130627.81	0.0242037
412.15	3576.7267	108535.29	134518.52	0.0251171
414.4	3647.0933	109880.73	137377.09	0.0260898
416.63	3702.7367	110603.15	139590.19	0.0272702
418.83	3765.15	111485.69	141922.68	0.0284912
420.99	3808.24	111799.42	143585.73	0.0296624
423.13	3847.7333	112005.26	145026	0.0308291
425.25	3874.97	111682.48	145887.9	0.0322093
427.33	3880.1267	110831.91	146052.11	0.0334195
429.39	3858.9433	108955.73	144817.27	0.0350646
431.43	3846.84	107325.28	144281.55	0.0366558
433.44	3965.8967	109434.33	149027.36	0.0380183
435.42	4200.48	114932.72	157989.94	0.0390681
437.38	4427.7233	120266.44	166263.84	0.0400678
439.32	4569.1167	123233.86	171315.7	0.0410247
441.24	4660.1067	124586.37	174402.11	0.0422124
443.14	4759.38	125802.42	177679.28	0.0437403
445.02	4923.59	128727.03	183580.36	0.0451518
446.87	5118.5533	132549.88	190282.42	0.0464648
448.71	5239.1033	134380.85	194152.71	0.0477806
450.53	5341.06	135340.42	197146.06	0.0494483
452.33	5493.36	137567.01	202080.94	0.0510377
454.11	5668.3767	140475.58	207991.04	0.0524143
455.88	5805.6067	142284.46	211951.74	0.0540015
457.63	5837.51	141449.05	212144.87	0.05559
459.36	5867.7633	140375.22	212415.7	0.0573034
461.08	5954.7467	140861.14	214960.49	0.0587698
462.78	6049.6767	141646.38	217410.81	0.0602155

464.47	6089.8133	141064.88	217831.9	0.0617265	542.3	7206.7767	93943.2	200086.08	0.143709
466.15	6146.3233	140713.43	218897.48	0.0633305	543.74	7263.27	93875.88	201029.43	0.1448592
467.81	6204.2833	140669.53	220065.24	0.0646844	545.18	7298.5067	93520.92	201271.29	0.1460954
469.46	6215.4433	139298.27	219146.78	0.0663763	546.62	7316.5667	92959.05	201105.29	0.1472718
471.1	6184.2467	137047.92	217020.9	0.0679476	548.07	7336.3867	92527.3	201072.96	0.1482926
472.72	6178.87	135158.74	215759.27	0.0697287	549.51	7357.07	92017.793	200866.06	0.1495385
474.33	6209.97	134168.02	215757.73	0.0714427	550.96	7359.8567	91320.683	200222.93	0.1507189
475.94	6252.8467	133264.03	216051.31	0.0733287	552.41	7363.68	90658.073	199623.48	0.1518757
477.53	6336.1567	133292.97	217860.66	0.075099	553.86	7339.7467	89634.973	198220.3	0.1531003
479.11	6422.5267	133437.43	219888.99	0.0767587	555.32	7279.9367	88217.96	195914.3	0.1542566
480.68	6475.0167	132965.42	220685.77	0.0783523	556.77	7230.65	86900.84	194127.86	0.1552746
482.24	6512.89	132086.78	221008.32	0.0800141	558.23	7229.2667	86292.877	193790.24	0.1560522
483.8	6560.5233	131612.37	221695.1	0.0814927	559.69	7239.3833	85887.26	193885.98	0.156671
485.34	6602.0167	131053.79	222138.23	0.0829461	561.16	7229.56	85267.403	193415.89	0.1572965
486.88	6616.6467	130031.73	221601.61	0.0843732	562.62	7190.86	84333.62	192410.93	0.1577081
488.41	6560.9467	127773.07	218804.83	0.0856683	564.09	7149.1533	83460.267	191594.92	0.157814
489.93	6397.98	123438.99	212234.73	0.0870883	565.56	7096.1733	82439.387	190516.94	0.1579024
491.45	6230.58	118731.7	206036.88	0.0886226	567.03	7036.64	81449.327	189545.4	0.1576572
492.95	6294.7367	118703.29	207932.72	0.0897772	568.51	7021.92	81068.2	189892.01	0.1572355
494.46	6461.0967	120830.66	212753.85	0.0908967	569.99	7031.1633	81061.13	190940.74	0.1566826
495.95	6497.3233	120795.08	213219.1	0.0917953	571.47	7003.9167	80758.81	191262.41	0.155802
497.44	6499.76	119658.01	212431.93	0.0931492	572.95	6949.4267	80275.3	191123.08	0.1545693
498.93	6544.0533	119267.48	213099.24	0.0944859	574.44	6910.9533	79966.553	191427.72	0.1533443
500.41	6579.27	118634.61	213108.41	0.0960426	575.93	6866.33	79747.43	191875.26	0.1517263
501.88	6550.55	116878.48	211149.64	0.0975421	577.42	6820.0533	79559.373	192286.86	0.1500614
503.35	6507.5733	114628.19	208560.94	0.0993563	578.92	6729.6433	79029.363	191874.97	0.1479089
504.82	6449.2233	112207.67	205743.52	0.1010047	580.42	6593.3867	77920.883	190205.62	0.1457313
506.28	6455.2933	110824.44	205157.11	0.1026655	581.92	6411.27	76272.187	187297.9	0.143433
507.74	6516.2	110309.98	206028.11	0.1045282	583.42	6151.12	73728.46	182371.91	0.1407982
509.2	6611.96	110723.87	208088.15	0.1060349	584.93	5907.51	71352.48	178275.52	0.1377923
510.65	6640.84	110042.09	207721.51	0.1076731	586.44	5796.1733	70677.573	178189.49	0.1345993
512.1	6650.98	108981.49	206941.98	0.1092882	587.95	5746.3833	71106.667	179893.82	0.1311654
513.55	6674.58	108213.13	206556.2	0.1108646	589.47	5658.2033	71225.653	180786.51	0.1273373
514.99	6663.2367	106982.15	205071.48	0.1123758	590.99	5567.07	71464.39	181943.65	0.1231495
516.44	6613.28	104955.71	202188.44	0.114189	592.51	5466.2067	71820.317	183291.54	0.1184446
517.88	6552.8733	102732.99	198839.81	0.1161698	594.03	5359.3267	72125.84	184397.62	0.1138008
519.32	6454.0767	99870.03	194392.14	0.1182255	595.56	5252.1633	72234.993	185059.9	0.1096514
520.76	6490.6567	99030.61	194358.06	0.1201886	597.09	5162.2167	72335.743	185777.29	0.1060904
522.2	6660.69	100452.52	198259.51	0.1219504	598.62	5099.2433	72429.39	186541.6	0.1034463
523.63	6786.4633	101407.71	200723.21	0.1235534	600.16	5037.7533	72306.747	186925.34	0.1012825
525.07	6866.57	101472.23	201780.63	0.1253441	601.7	4978.7433	71900.397	186511.12	0.0999028
526.5	6895.1467	100854.58	201226.16	0.1271217	603.24	4912.24	71233.303	185657.44	0.0987437
527.94	6873.5567	99372.167	199404.65	0.1289106	604.79	4851.3133	70544.81	184775.98	0.0977985
529.37	6951.77	99357.753	200768.66	0.1304951	606.34	4797.77	69946.243	184087.98	0.0969085
530.81	7073.5367	99983.627	203095.83	0.1322248	607.89	4750.2933	69380.167	183502.09	0.096135
532.24	7117.3233	99715.553	203277.55	0.133692	609.44	4704.1167	68814.407	182962.29	0.0953769
533.67	7114.8933	98637.333	202272.12	0.1352189	611	4669.9733	68377.22	182752.97	0.0947331
535.11	7156.0267	98178.95	202644.33	0.1366438	612.56	4656.1067	68208.44	183270.96	0.094152
536.55	7194.04	97719.803	202728.36	0.1381638	614.12	4636.61	67998.62	183598.44	0.0935179
537.98	7189.8667	96716.457	201828.79	0.1395243	615.69	4595.32	67419.623	182908.25	0.0930093
539.42	7156.1233	95271.167	200064.45	0.1409659	617.25	4546.31	66632.253	181676.7	0.0927073
540.86	7155.0233	94222.09	199325.26	0.14238	618.82	4489.1667	65791.667	180315.34	0.0922361

620.4	4446.5367	65068.107	179415.85	0.0919151	704.45	2460.51	46232.833	159759.5	0.0458573
621.97	4402.52	64386.47	178605.46	0.0914552	706.08	2396.45	46355.123	160379.63	0.0430361
623.55	4372.5	63901.023	178163.57	0.0911026	707.71	2315.4	46247.423	160331.14	0.0399911
625.13	4359.8533	63637.08	178201.66	0.0908978	709.34	2225.6067	45713.027	158682.89	0.0374435
626.71	4354.3333	63569.88	178763.78	0.0904841	710.97	2082.14	44129.92	153624.32	0.0346217
628.3	4352.5467	63545.85	179396.33	0.0901261	712.6	1872.61	40633.95	142195.17	0.0324713
629.89	4342.1	63346.827	179472.44	0.0899172	714.23	1620.7967	35749.207	126794.04	0.0307147
631.47	4326.6933	63131.543	179353.94	0.0896481	715.86	1435.7433	32207.14	116675.24	0.0287539
633.07	4314.6	62952.423	179248.67	0.0894526	717.49	1397.9867	32208.157	118030.23	0.0264123
634.66	4292.3333	62572.117	178912.51	0.0892127	719.11	1419.2233	33789.127	123528.44	0.0240653
636.26	4260.8533	62035.243	178259.19	0.0889599	720.74	1387.23	33931.077	123500.9	0.0222408
637.86	4214.8533	61404.22	177318.72	0.0884278	722.36	1312.73	32681.383	119720.04	0.0208697
639.46	4155.5567	60412.133	175424.57	0.0882537	723.99	1256.15	32109.607	118422.51	0.0189458
641.06	4060.1467	59080.42	172834.05	0.0874636	725.61	1229.85	32160.713	119071.23	0.0173792
642.66	3986.62	57992.783	170986.25	0.086826	727.23	1215.32	32654.11	121170.09	0.0156084
644.27	3937.3567	57566.783	170540.35	0.0856775	728.85	1228.3867	34071.03	126360.31	0.0136443
645.88	3885.3367	57278.93	170342.2	0.0841556	730.47	1275.9767	36343.763	134111.83	0.0121038
647.49	3819.3633	56848.863	169685.31	0.0824844	732.08	1316.0233	38402.367	140627.53	0.0107569
649.1	3707.1667	55891.05	167391.37	0.08041	733.7	1320.5567	39394.473	143803.93	0.0095037
650.71	3594.5967	54993.887	165722.73	0.0779041	735.32	1325.4267	39911.153	145541.13	0.0089759
652.32	3561.3567	55350.773	167813.54	0.0753148	736.93	1329.6267	40512.433	147510.47	0.0083179
653.94	3572.4367	56525.667	172018.15	0.072677	738.54	1339.11	41168.81	149587.15	0.0078288
655.56	3574.9833	57358.2	175052.43	0.070672	740.15	1363.5033	41851.54	151866.09	0.0079296
657.18	3544.84	57624.75	176443.19	0.0687757	741.76	1373.6733	42419.967	153753.49	0.0075974
658.8	3508.49	57511.65	176837.55	0.0674433	743.37	1381.1533	42796.12	155111.24	0.0074073
660.42	3477.5867	57319.963	177057.09	0.0664535	744.97	1381.7667	42883.51	155623.89	0.0073089
662.04	3455.09	57052.16	176959.72	0.0659576	746.58	1380.46	42763.82	155399.03	0.0074021
663.66	3441.04	56782.823	176724.85	0.0658138	748.18	1366.8367	42478.45	154753.51	0.0072043
665.29	3436.3	56541.987	176480.62	0.0659762	749.78	1361.73	42220.717	154142.47	0.0073188
666.92	3443.51	56313.433	176415.27	0.0664854	751.38	1351.2	42031.23	153890.11	0.0071175
668.54	3455.02	56093.84	176497.7	0.067083	752.98	1344.1533	41818.92	153521.88	0.0070895
670.17	3476.47	55881.653	176580.25	0.0680262	754.57	1331.6467	41230.253	151633.56	0.0073426
671.8	3493.34	55617.533	176512.56	0.0689161	756.16	1248.8967	38822.523	142277.68	0.0071482
673.43	3507.47	55300.283	176294.84	0.0698214	757.76	1057.1667	32631.423	119163.61	0.0075657
675.06	3515.6367	54944.817	175848.64	0.070646	759.35	828.25	24995.097	92748.85	0.0086975
676.69	3509.6867	54426.013	174959.11	0.0713132	760.93	714.74667	21091.933	81523.867	0.0095702
678.32	3478.61	53572.39	172778.39	0.0719523	762.52	753.87333	22075.443	87329.683	0.0097677
679.95	3393.04	51937.563	168106.46	0.0724646	764.1	855.6	25559.293	101090.41	0.0086978
681.58	3234.4433	49091.477	159824.83	0.0731174	765.69	1000.73	30317.39	118664.32	0.00804
683.22	3072.6367	46264.34	152424.28	0.0732606	767.27	1132.2667	34516.903	133437.8	0.0078067
684.85	3013.07	45398.2	151239.63	0.0723673	768.85	1211.1233	37095.253	142153.49	0.0076226
686.48	3005.4733	45776.04	153170.84	0.0707093	770.42	1245.2467	38270.787	146228.44	0.0074621
688.12	2970.6533	45621.467	153390.98	0.0693588	772	1265.85	38734.797	147907.43	0.0077007
689.75	2909.0333	45172.423	152678.69	0.067664	773.57	1265.8567	38845.837	148584.87	0.0075344
691.38	2876.6667	45405.787	154097.26	0.0654549	775.14	1271.38	38811.987	148758.25	0.0077989
693.02	2864.83	46106.453	156564.29	0.0631612	776.7	1270.28	38670.937	148762.81	0.007919
694.65	2807.9633	45938.31	156180.03	0.0612182	778.27	1266.5967	38521.873	148512.9	0.0079531
696.29	2702.4	45048.26	153908.15	0.0588297	779.83	1260.6867	38329.08	148318.72	0.0079418
697.92	2627.5433	44620.32	153360.39	0.0564639	781.4	1261.2733	38137.407	148044.41	0.0082092
699.55	2591.32	45009.947	155047.46	0.0539395	782.96	1250.55	37824.98	147400.71	0.0081609
701.19	2559.1533	45606.987	157147.54	0.0512641	784.51	1245.0533	37324.813	146155.84	0.0085961
702.82	2515.9133	45973.957	158682.89	0.0486492	786.07	1221.9067	36611.61	144217.46	0.0085733

787.62	1199.8067	35667.983	141361.58	0.0089386	865.69	873.06	26419.423	119524.15	0.0070082
789.17	1169.38	34785.937	138796.85	0.0088444	867.15	880.10333	26571.027	120950.31	0.0070709
790.72	1162.0733	34268.093	137372.08	0.0092651	868.62	903.23333	26938.66	122839.58	0.0076188
792.27	1159.2933	34119.22	137074.7	0.0093488	870.08	898.30333	27042.03	123379.8	0.0071869
793.81	1163.5667	34029.11	136900.42	0.0096727	871.54	896.96667	26926.207	123071.57	0.0073023
795.35	1154.1567	33752.213	136439.19	0.0096291	873	895.26333	26758.863	122616.45	0.0074822
796.89	1157.3933	33485.187	136175.7	0.010142	874.46	895.03667	26621.253	122241.16	0.0076916
798.43	1151.2833	33324.193	135903.98	0.0100882	875.91	884.48667	26510.843	121987.79	0.0073234
799.97	1141.1167	32902.53	134769.25	0.0102496	877.37	883.81333	26283.48	121217.39	0.007665
801.5	1123.0733	32432.753	133481.79	0.0101183	878.83	873.56333	25964.09	120339.15	0.0076527
803.03	1126.25	32231.947	133243.25	0.0105514	880.29	866.48333	25828.563	119788.32	0.0075156
804.56	1132.08	32385.153	134004.09	0.0105637	881.74	870.66667	25750.62	119677.06	0.0078568
806.09	1141.13	32603.683	134809.53	0.0106372	883.2	857.48667	25536.017	119032	0.0075208
807.61	1136.6733	32303.833	133973.35	0.0108883	884.66	848.88	25190.48	117770.88	0.0076583
809.14	1102.5733	31405.557	130888.99	0.0107153	886.11	846.86333	24981.89	117232.14	0.0078985
810.66	1050.74	29951.92	125712.21	0.0106002	887.57	840.79667	24883.837	116957.71	0.0077386
812.17	974.66	27766.927	117550.92	0.0105397	889.03	826.89333	24429.43	115205.91	0.0077919
813.69	888.34667	25141.673	107629.31	0.0107637	890.48	790.37	23417.683	110831.71	0.0076349
815.21	814.00333	22868.583	99287.483	0.0109911	891.94	726.33333	21693.727	103552.67	0.0072149
816.72	774.62333	21802.27	95660.73	0.0107823	893.39	660.43	19547.75	94188.633	0.0075443
818.23	779.12333	22007.62	97272.507	0.0105229	894.85	589.39667	17447.063	84982.647	0.0074585
819.74	817.06667	23045.65	101450.88	0.0106394	896.31	537.92333	15903.21	78175.067	0.0074453
821.25	817.1	23294.807	102059.16	0.0101486	897.76	506.88	14917.147	74189.627	0.0075544
822.75	794.08667	22852.88	100675	0.0096241	899.22	498.22333	14776.26	74536.713	0.007122
824.25	815.88333	23483.817	103997.82	0.0095661	900.68	544.06	15756.063	79824.913	0.0080987
825.75	845.28667	24602.547	108354.29	0.0090701	902.14	582.67	17137.96	85851.103	0.0075241
827.25	834.50333	24483.487	107864.74	0.0086773	903.59	574.22333	17178.207	85343.887	0.006864
828.75	816.80333	24125.953	106787.24	0.0083125	905.05	535.88667	15738.703	78740.12	0.0075969
830.25	812.11333	24235.447	107589.89	0.0077975	906.51	501.93667	14544.187	73378.233	0.0081089
831.74	815.08333	24578.223	109049.03	0.0073113	907.97	487.02	14132.76	71931.893	0.0079752
833.23	826.23667	25123.41	111531.94	0.0069169	909.43	480.87667	14040.937	71388.857	0.0077215
834.72	853.45333	25956.727	115127.78	0.0069128	910.89	460.37333	13532.023	69052.467	0.0074137
836.21	876.74	26762.873	118501.13	0.0067539	912.35	452.47667	13044.467	67262.583	0.0081485
837.7	899.00667	27436.623	121249.27	0.0067771	913.82	436.32333	12938.123	66914.36	0.0069538
839.18	912.94333	27928.477	123331.12	0.0066711	915.28	462.97	13357.09	69072.68	0.0080933
840.67	930.23	28314.403	124920.1	0.0069122	916.74	481.81	14433.077	74694.88	0.0065346
842.15	933.11	28532.293	125805.19	0.0067027	918.21	543.92667	15534.543	79717.893	0.0085879
843.63	938.27	28713.26	126667.59	0.0066617	919.68	540.96	15689.647	80128.727	0.0079707
845.11	944.81	28910.63	127469.07	0.0066698	921.14	523.97333	15288.57	78073.833	0.0077173
846.59	944.66667	28925.463	127532.81	0.0066389	922.61	501.13333	14819.547	76047.667	0.0071208
848.07	934.62333	28509.593	125763.47	0.0068123	924.08	484.93667	14025.22	72177.613	0.0080288
849.54	914.57	28039.91	123836.4	0.0065681	925.55	417.83333	12190.95	62544.153	0.0076839
851.02	899.02667	27589.757	122360.04	0.0064965	927.02	331.75333	9751.03	50174.547	0.0073539
852.49	871.32333	26973.897	119782.1	0.0060876	928.49	284.57333	7597.2633	39012.51	0.0115718
853.96	874.21333	26582.02	118489.91	0.0068891	929.97	215.19	5910.02	29550.113	0.0105696
855.43	888.63333	27079.49	121409.06	0.0067489	931.44	189.54	4768.2	23950.62	0.014699
856.9	909.54667	27811.1	124633.97	0.0065958	932.92	173.25	4429.5833	22082.36	0.0140052
858.37	910.29	28007.857	125681.35	0.0063026	934.4	170.03667	4464.0467	22684.26	0.0124763
859.83	915.66667	28049.557	126020.26	0.0064955	935.88	204.69	5029.41	26940.487	0.0148952
861.3	923.6	28014.753	126280.47	0.0069254	937.36	227.70333	5900.46	31561.53	0.0124404
862.76	904.19	27731.51	124943.78	0.0064222	938.84	226.30333	5974.5033	31562.277	0.0117487
864.23	890.81	26961.847	121598.85	0.007021	940.32	195.65	5632.6967	29656.633	0.008037

941.81	212.77	5400.7633	28243.68	0.0136923	1020.8	795.29333	19376.217	97604.087	0.0162712
943.29	214.51667	5277.06	27908.357	0.0150299	1022.33	764.64	19068.74	97798.08	0.0148227
944.78	201.94	5359.6133	28708.317	0.0113526	1023.86	765.92667	19482.02	97960.003	0.0141385
946.27	225.06333	5612.73	29653.003	0.0143888	1025.39	719.43	19445.223	98336.1	0.0111793
947.76	211.76	5669.61	30448.743	0.010939	1026.91	748.58333	19463.14	98299.56	0.0130148
949.25	207.00333	5830.6233	30590.637	0.0089852	1028.44	837.12667	19198.087	98758.527	0.0190598
950.74	201.61	5843.69	30901.437	0.0077238	1029.96	724.23333	19717.86	98682.75	0.0109598
952.24	201.69333	6062.6667	32033.673	0.0062646	1031.48	768.85	19672.83	99194.01	0.0138093
953.74	228.97	6278.6567	33622.74	0.0099356	1033	803.62	20052.21	99291.587	0.0153238
955.23	235.87667	6727.04	35632.487	0.0083793	1034.51	891.41667	20169.977	99200.1	0.02069
956.73	276.15	6751.7367	36240.957	0.015101	1036.02	793.20333	19760.493	99526.07	0.0151457
958.24	274.06333	7081.58	38507.65	0.0123647	1037.53	813.11	20211.483	99895.84	0.0155475
959.74	290.93	7698.4467	41714.833	0.0113529	1039.03	820.46333	20238.13	99185.063	0.0160775
961.24	298.29667	8274.56	44641.12	0.0093751	1040.54	812.63667	20395.53	101722.71	0.0149207
962.75	309.16333	8774.9767	47308.577	0.0084288	1042.03	862.82	20574.903	100485.18	0.0179283
964.26	350.96	9653.1167	52784.63	0.0096028	1043.53	850.93	20769.62	101555.81	0.0166664
965.77	375.55	11381.667	61360.84	0.0058227	1045.02	836.96333	20887.707	101745.68	0.0155686
967.28	447.10333	12546.417	67959.767	0.0088575	1046.5	910.58333	21095.153	100922.86	0.0199173
968.79	474.35	13225.917	70900.957	0.0092186	1047.98	1048.9367	21216.267	102281.42	0.0279435
970.3	446.74333	13061.953	69919.037	0.0072797	1049.46	827.49667	21514.93	102940.67	0.0137381
971.82	451.33333	12420.733	66638.67	0.0097637	1050.93	927.93333	21838.79	102202.08	0.0194546
973.34	419.22	12252.917	65809.773	0.0072693	1052.39	1124.4533	22129.217	102729.95	0.0308768
974.85	437.21333	12555.913	67951.393	0.0079195	1053.85	944.81333	22486.583	104874.4	0.0188835
976.37	463.62	12950.98	70014.33	0.0090632	1055.3	1082.46	22731.57	104309.38	0.0268638
977.9	499.75667	13481.75	72212.587	0.0106385	1056.75	791.85333	23295.743	104013.45	0.0084312
979.42	489.79	14219.66	76343.793	0.007542	1058.19	1071.5433	23038.25	105440.17	0.0254135
980.94	526.93667	14979.377	80029.447	0.008441	1059.62	1053.2133	22062.133	103104.44	0.0265378
982.47	553.71667	15553.27	83016.4	0.008948	1061.05	1078.0367	23542.043	105123.38	0.0250351
983.99	590.25333	16326.173	86637.553	0.0096543	1062.46	1097.0233	23768.853	107020.78	0.0253331
985.52	615.67333	16948.123	89443.673	0.0099137	1063.87	1145.1833	23539.91	108156.34	0.0282373
987.05	603.71	17271.337	91168.877	0.0082779	1065.27	1159.6533	24385.84	108676.03	0.0275694
988.58	635.96333	17627.877	92653.84	0.0096555	1066.67	1324.9067	24595.72	106807.93	0.0374273
990.11	641.53	18072.743	93809.63	0.0090751	1068.05	1078.1433	24206.027	106283.93	0.0236689
991.64	664.31667	18129.71	94983.1	0.0103648	1069.42	1033.16	24510.803	108303.55	0.0201228
993.17	675.86667	18364.207	95818.297	0.0106013	1070.79	1227.2167	23389.353	106262.74	0.0338403
994.71	689.28333	18546.137	96439.903	0.0110752	1072.14	1419.82	26066.453	110381.97	0.039274
996.24	682.84667	18548.943	97188.313	0.0105687	1073.48	1211.85	24677.643	106348.9	0.0307738
997.77	651.55333	18663.913	96808.55	0.0083702	1074.82	993.16	23835.787	108290.98	0.0189009
999.31	690.67	18432.197	96391.347	0.0113791	1076.14	1034.1133	25114.12	107252.08	0.0193863
1000.85	670.09	18427.477	96001.567	0.010087	1077.44	1335	25216.613	107096.44	0.0368987
1002.38	680.79667	18416.087	95680.583	0.0108449	1078.74	1278.2367	25113.58	107371.83	0.0336512
1003.92	660.67	18213.103	95041.44	0.009963	1080.02	1034.3867	25438.233	108495.59	0.0186544
1005.45	721.64	18330.847	95083.567	0.0137696	1081.3	1088.49	24724.237	106982.85	0.0232698
1006.99	664	18489.843	95462.753	0.0096282	1082.55	1147.1333	25632.55	106960.52	0.0252255
1008.53	733.59667	18505.123	96385.267	0.014045	1083.79	1148.1867	25752.197	106289.33	0.0252491
1010.06	721.07	18679.137	96911.757	0.0128407	1085.02	1298.2767	25965.523	107212.48	0.0334776
1011.6	706.15	18631.02	97292.167	0.0119139	1086.24	1510.19	26924.503	109078.75	0.0435648
1013.13	740.26667	18891.6	97300.623	0.0136448	1087.43	1070.9933	26774.827	108527.3	0.0186016
1014.67	738.96	18751.13	97973.91	0.0137195	1088.62	1059.6	26904.61	110198.33	0.0174627
1016.2	727.71667	18872.607	98521.403	0.0127093	1089.78	1676.7133	26060.9	108459.34	0.0548614
1017.74	692.05333	19177.337	98054.56	0.0099378					
1019.27	728.42667	19008.483	98233.62	0.0125486					

APPENDIX E-3

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Wavelength (nm)	L_w	L_s	E_d	R_{rs}
107.95	0	0	0.03	0
115.33	0.01	0.06	0.21	0.2489338
122.58	0.01	0.06	0.22	0.2376186
129.71	0.01	0.0633333	0.24	0.2153736
136.72	0.01	0.07	0.25	0.2020672
143.6	0.01	0.0766667	0.27	0.1827554
150.37	0.01	0.08	0.28	0.174134
157.02	0.01	0.0833333	0.29	0.1661072
163.55	0.01	0.09	0.31	0.1516072
169.97	0.01	0.0933333	0.3266667	0.1420769
176.28	0.01	0.0933333	0.3366667	0.1378568
182.48	0.01	0.1033333	0.35	0.1275786
188.57	0.01	0.1066667	0.37	0.1190975
194.55	0.01	0.1133333	0.38	0.1128769
200.43	0.01	0.1133333	0.3933333	0.1090505
206.21	0.01	0.12	0.4133333	0.1009363
211.88	0.01	0.1233333	0.4266667	0.0964076
217.46	0.01	0.13	0.4333333	0.0922178
222.94	0.01	0.1333333	0.4533333	0.0868558
228.33	0.0133333	0.1433333	0.47	0.1245942
233.62	0.0166667	0.1433333	0.4833333	0.1644895
238.82	0.0133333	0.15	0.4966667	0.1155431
243.92	0.0166667	0.1533333	0.5133333	0.1514493
248.94	0.0166667	0.1566667	0.53	0.1455802
253.87	0.02	0.2233333	0.7366667	0.1172482
258.72	0.03	0.3133333	1.02	0.130756
263.48	0.0533333	0.5066667	1.65	0.1490702
268.16	0.0766667	0.7533333	2.46	0.1419421
272.75	0.1133333	1.1033333	3.5666667	0.1452297
277.27	0.1533333	1.53	4.8433333	0.1433414
281.71	0.3033333	3.0933333	9.7233333	0.1400437
286.07	0.6566667	6.5833333	20.133333	0.1474052
290.36	0.9933333	10.423333	31.286667	0.1408756
294.57	1.4233333	15.61	44.98	0.1377682
298.71	1.9733333	21.25	59.7	0.145064
302.78	4.6233333	52.743333	140.68667	0.1405262
306.78	8.69	102.49	261.37	0.1399162
310.71	13.59	168.63	402.87667	0.1383092
314.57	19.926667	262.94667	594.05	0.1328894
318.37	28.53	387.55333	815.21333	0.1362555
322.1	49.706667	692.80333	1384.2233	0.1375731
325.77	86.066667	1246.33	2357.4033	0.1363818
329.38	132.93333	1976.9233	3554.4	0.1371388
332.93	234.36333	3533.3433	6140.8267	0.1385693
336.42	355.78	5504.2033	9317.5633	0.1359885
339.85	481.58667	7520.82	12521.99	0.1359821
343.22	599.66	9329.89	15467.18	0.1374766
346.53	722.53	11259.057	18574.93	0.137766
349.79	837.37333	13150.987	21627.64	0.1362945
353	973.96	15177.177	24971.96	0.1381334
356.16	1057.8167	16486.423	27263.747	0.1373991
359.26	1138.8767	17727.513	29602.63	0.1363725
362.32	1246.32	19347.437	32629.793	0.135676
365.32	1394.76	21553.277	36592.473	0.1358663
368.28	1544.16	23810.293	40578.69	0.1358673
371.19	1697.79	26183.687	44829.553	0.1352022
374.05	1854.0567	28462.413	49101.367	0.1352714
376.87	1986.83	30302.447	52828.627	0.1353913
379.64	2123.9233	32187.783	56972.487	0.1348411
382.37	2370.4567	35737.227	64366.497	0.1337155
385.06	2735.94	41078.503	74783.417	0.1332315
387.71	3148.5833	47144.713	86406.83	0.132964
390.32	3538.3567	52827.417	97330.353	0.1329315
392.89	3865.27	57464.767	106370.03	0.1332751
395.42	4054.12	59891.337	111894.8	0.1334839
397.92	4184.1033	61384.81	116038.28	0.1334914
400.37	4311.39	62825.367	120242.27	0.1333678
402.8	4501.1433	65154.613	126278.34	0.1331893
405.18	4684.0867	67398.737	132221.98	0.1329097
407.54	4853.2067	69334.407	137762.01	0.1328062
409.86	4994.34	70917.147	142543.74	0.1326187
412.15	5116.91	72129.697	146726.41	0.1326331
414.4	5195.4167	72746.06	149781.88	0.1324967
416.63	5251.7533	72935.23	152123.41	0.1325654
418.83	5309.4933	73221.907	154663.64	0.1324077
420.99	5343.6133	73129.05	156347.19	0.1324576
423.13	5376.8267	72976.053	157843.17	0.1326949
425.25	5379.2933	72467.133	158679.11	0.1326577
427.33	5368.8133	71663.327	158769.47	0.1330582
429.39	5309.69	70185.003	157482.3	0.1334383
431.43	5268.4033	68893.98	156784.32	0.1338265
433.44	5400.4733	69899.68	161675.85	0.1338158
435.42	5682.72	73100.273	171269.61	0.1333868
437.38	5971.1933	76225.837	180237.31	0.1337557
439.32	6138.3767	77851.483	185764.62	0.133891
441.24	6244.9933	78454.41	189074.57	0.1345291
443.14	6351.5767	78900.4	192532.84	0.1351834
445.02	6538.7033	80438.48	198867.59	0.1354288
446.87	6768.8733	82492.05	206036.96	0.135982
448.71	6911.42	83381.343	210284.95	0.1367503
450.53	7015.45	83641.983	213440.96	0.1375758
452.33	7190.4867	84680.033	218592.5	0.1385293
454.11	7390.0067	86117.003	224794.46	0.1391595
455.88	7542.3433	86900.377	228964.17	0.1402037
457.63	7562.4733	86065.733	229150.57	0.1412824
459.36	7573.11	85079.063	229204.33	0.1422982
461.08	7662.44	85041.613	231856.03	0.14312
462.78	7758.55	85215.487	234506.3	0.1439472

464.47	7788.2633	84552.923	235003.14	0.1449333	542.3	9416.7067	48861.983	213367.78	0.2370117
466.15	7835.23	84075.22	236070.94	0.1458838	543.74	9534.1867	48743.933	214353.79	0.239462
467.81	7894.6067	83745.41	237361.25	0.1469069	545.18	9614.03	48453.35	214448.4	0.2419341
469.46	7886.1067	82663.707	236366.79	0.1481042	546.62	9681.8	48081.8	214223.01	0.2444815
471.1	7841.1267	81072.687	234070.92	0.1495453	548.07	9750.18	47764.183	214088.79	0.2469026
472.72	7811.2267	79689.02	232703.04	0.1506631	549.51	9814.9167	47418.597	213804.66	0.2494175
474.33	7833.21	78811.783	232659.09	0.1519486	550.96	9860.4633	46992.873	213157.49	0.2518687
475.94	7860.9633	78007.483	232968.19	0.1531029	552.41	9910.1267	46565.25	212526.6	0.2544386
477.53	7945.1	77712.683	234811.21	0.1543734	553.86	9918.3267	45979.16	211012.42	0.2569972
479.11	8033.38	77537.503	236858.75	0.1555108	555.32	9882.5367	45193.223	208669.82	0.2594673
480.68	8083.4667	76978.38	237679.66	0.1567117	556.77	9857.2933	44457.767	206791.68	0.2616826
482.24	8104.3033	76139.43	237875.5	0.1577535	558.23	9899.67	44078.187	206509.1	0.2636534
483.8	8127.52	75567.357	238460.28	0.1584004	559.69	9951.5467	43782.363	206663.66	0.2652852
485.34	8150.2867	74955.237	238724.42	0.1592755	561.16	9972.7233	43414.223	206235.98	0.2667946
486.88	8139.8967	74150.953	237987.36	0.160089	562.62	9949.8467	42878.337	205253.17	0.2678311
488.41	8052.31	72609.547	234939.52	0.1609777	564.09	9923.31	42361.553	204562.05	0.2683653
489.93	7830.44	69943.803	227935.75	0.1618656	565.56	9873.03	41795.553	203654.68	0.2684987
491.45	7606.7833	67086.5	221247.18	0.1626794	567.03	9799.0567	41208.347	202525.16	0.2682113
492.95	7659.73	66866.553	223171.72	0.1629406	568.51	9796.14	40939.353	202809.79	0.2679779
494.46	7838.1367	67845.297	228373.57	0.1633836	569.99	9819.2233	40857.54	203952.75	0.2672578
495.95	7881.2467	67622.443	228929.85	0.164341	571.47	9791.6967	40652.087	204258.13	0.2661885
497.44	7871.7333	66787.687	228125.78	0.165302	572.95	9732.6567	40344.59	203996.89	0.2649761
498.93	7919.15	66383.127	228798.5	0.1664292	574.44	9681.2833	40140.043	204126.54	0.2634027
500.41	7952.6033	65839.507	228906.87	0.1676865	575.93	9633.1633	39996.79	204534.6	0.2615222
501.88	7924.0767	64701.063	226804.2	0.1693339	577.42	9572.9667	39845.477	204944.06	0.2592841
503.35	7873.06	63287.843	223968.98	0.1711564	578.92	9467.64	39549.933	204583.08	0.256761
504.82	7814.2533	61767.34	220985.81	0.1730053	580.42	9282.4933	38939.65	202933.43	0.2536448
506.28	7838.7	60866.207	220419.97	0.1748656	581.92	9033.5267	38088.407	200261.98	0.2499649
507.74	7917.1967	60388.383	221354.23	0.1767354	583.42	8681.04	36799.383	195649.15	0.2456975
509.2	8054.64	60429.243	223362.67	0.1789803	584.93	8349.92	35570.56	191764.56	0.2409527
510.65	8106.8133	59845.623	222790.86	0.181372	586.44	8196.2267	35222.963	191787.01	0.2362082
512.1	8138.3733	59105.453	221656.75	0.1837821	587.95	8130.6367	35376.907	193505.84	0.2318404
513.55	8187.47	58495.62	221003.86	0.1862063	589.47	8009.8633	35373.75	194229.02	0.2270731
514.99	8198.3233	57680.443	219242.53	0.1886674	590.99	7873.0933	35450.013	195091.35	0.2215957
516.44	8159.8933	56424.717	216038.91	0.19137	592.51	7736.9433	35559.4	196080.51	0.2160169
517.88	8113.0667	55131.51	212403.53	0.1943313	594.03	7581.1833	35656.613	196843.44	0.210121
519.32	8024.8233	53496.85	207689.66	0.1974571	595.56	7425.9067	35657.26	197153.87	0.204841
520.76	8093.7933	52972.55	207588.18	0.2000855	597.09	7294.21	35641.507	197569.58	0.2002357
522.2	8327.02	53620.483	211707.58	0.2025757	598.62	7200.7167	35635.437	198168.23	0.1966719
523.63	8515.46	54017.7	214412.45	0.2052163	600.16	7115.0933	35541.523	198492.36	0.1937236
525.07	8643.4433	53971.737	215563.81	0.2078881	601.7	7014.7833	35301.65	198017.28	0.1912186
526.5	8711.85	53574.793	215146.61	0.2106136	603.24	6913.3767	34950.39	197045.65	0.1892416
527.94	8711.4467	52708.147	213192.12	0.2132477	604.79	6813.2233	34606.29	196099.14	0.1872547
529.37	8839.0467	52604.68	214578.81	0.2156908	606.34	6732.2067	34278.153	195326.25	0.1856851
530.81	9021.29	52861.707	217134.87	0.218217	607.89	6663.36	33959.33	194653.55	0.1843927
532.24	9110.4533	52619.887	217321.12	0.2208036	609.44	6592.0567	33671.483	193975.21	0.1829889
533.67	9131.1833	51912.223	216170.81	0.2231571	611	6538.7067	33432.227	193742.31	0.181696
535.11	9207.53	51584	216349.38	0.225457	612.56	6513.9967	33303.787	194207.23	0.1805779
536.55	9279.7233	51233.36	216463.98	0.2277182	614.12	6487.6	33166.78	194495.22	0.1795817
537.98	9308.3	50607.237	215360.17	0.2302305	615.69	6425.55	32861.83	193755.78	0.1785318
539.42	9287.45	49735.003	213457.44	0.2323879	617.25	6352.4	32464.88	192481.75	0.1776885
540.86	9320.3467	49086.587	212637.53	0.2347925	618.82	6272.88	32010.367	191089.35	0.176787

620.4	6216.8067	31635.83	190227.27	0.1760824	704.45	3917.26	22561.653	169605.53	0.1217155
621.97	6162.5567	31268.61	189425.22	0.1753696	706.08	3824.57	22644.903	170015.68	0.1179102
623.55	6114.2733	31007.017	189065.13	0.1743424	707.71	3711.8167	22617.487	169849.4	0.113883
625.13	6097.5067	30865.88	189025.03	0.1739534	709.34	3572.8567	22413.527	168392.03	0.1098967
626.71	6097.89	30808.96	189384.07	0.1736893	710.97	3360.98	21700.893	163756.86	0.1056435
628.3	6098.0567	30761.31	189663.75	0.1734828	712.6	3034.1267	20071.2	153194.33	0.1013932
629.89	6078.7867	30539.493	188845.96	0.1737996	714.23	2630.89	17746.793	138490.56	0.0968166
631.47	6061.4233	30314.26	188159	0.1740649	715.86	2327.97	16045.543	128505.25	0.0918576
633.07	6069.4533	30276.75	188631.57	0.1739313	717.49	2272.9633	16052.243	129504.41	0.0884711
634.66	6054.9833	30128.95	188735.25	0.1734918	719.11	2317.9233	16868.593	134927.94	0.0859441
636.26	6021.3333	29884.087	188118.88	0.1731653	720.74	2281.2467	16985.267	135188.52	0.083922
637.86	5972.81	29572.5	187362.27	0.17253	722.36	2158.7433	16404.167	131582.99	0.0811489
639.46	5890.2167	29111.11	186048.84	0.1713949	723.99	2084.74	16166.113	130410.82	0.0786339
641.06	5763.2833	28499.43	184096.18	0.1694652	725.61	2054.79	16212.89	130947.05	0.076812
642.66	5641.7433	27984.81	182258.65	0.1674805	727.23	2036.7	16488.19	132834.66	0.0745002
644.27	5565.9567	27767.02	181560.48	0.1657129	728.85	2075.17	17204.767	137680.18	0.0727182
645.88	5494.9367	27619.637	181215.77	0.1637087	730.47	2172.0133	18361.857	144864.25	0.0719072
647.49	5397.09	27424.84	180440.97	0.1611945	732.08	2258.46	19413.443	150909.49	0.0714
649.1	5229.22	26948.727	177824.27	0.158106	733.7	2292.8133	19947.247	153915.38	0.0707978
650.71	5055.7367	26533.563	175979.73	0.1539842	735.32	2305.2533	20250.113	155340.47	0.0703085
652.32	4985.8967	26695.223	178011.59	0.1496017	736.93	2340.92	20576.71	156835.17	0.0707009
653.94	4982.1733	27272.38	182298.22	0.1453986	738.54	2371.1733	20942.813	158503.64	0.0707496
655.56	4959.4767	27658.213	185255.74	0.1419412	740.15	2415.7433	21318.017	160358.92	0.0712658
657.18	4903.51	27789.71	186616.94	0.1388976	741.76	2459.0567	21643.247	162081.06	0.0718346
658.8	4833.7667	27723.047	186868.08	0.1364286	743.37	2478.3333	21878.46	163291.54	0.0717904
660.42	4781.62	27613.493	187005.93	0.1346791	744.97	2492.0533	21954.107	163680.98	0.072065
662.04	4745.2333	27454.633	186605.57	0.1338926	746.58	2491.2367	21933.863	163433.28	0.0721646
663.66	4721.92	27264.047	186006.15	0.1337168	748.18	2478.2567	21818.393	162718.22	0.0721053
665.29	4721.9	27088.277	185576.12	0.1341927	749.78	2467.2633	21722.203	162022.73	0.072093
666.92	4758.1667	26968.587	185461.24	0.135618	751.38	2462.6267	21652.24	161704.37	0.0721309
668.54	4808.3367	26853.093	185621.74	0.1373084	752.98	2453.2133	21566.283	161355.9	0.0720138
670.17	4870.4767	26762.233	185792.64	0.1393696	754.57	2422.82	21272.49	159478.42	0.0719883
671.8	4936.0533	26643.37	185744.41	0.1417367	756.16	2286.6933	20109.227	150306.73	0.0720521
673.43	4997.4367	26505.333	185522.06	0.1441163	757.76	1930.32	16966.563	127319.61	0.0718165
675.06	5057.9667	26336.21	185152.31	0.1466189	759.35	1495.1	13041.79	100480.84	0.0706558
676.69	5093.9333	26112.757	184278.66	0.1487537	760.93	1261.2067	10956.91	88668.807	0.0676309
678.32	5093.93	25695.56	182171.07	0.1508775	762.52	1320.71	11418.153	94515.97	0.0665441
679.95	5017.4733	24925.88	177549.3	0.1528619	764.1	1530.7467	13200.727	108252.64	0.0673939
681.58	4838.4167	23595.593	169357.11	0.1549951	765.69	1802.9833	15659.703	125801.76	0.0681507
683.22	4647.1067	22226.127	161898.15	0.1561995	767.27	2057.1933	17878.517	140573.71	0.0695747
684.85	4592.6333	21812.107	160672.52	0.1557141	768.85	2210.77	19274.173	149356.65	0.0703001
686.48	4621.6	22031.397	162964.73	0.154404	770.42	2288.8033	19931.723	153520.34	0.0708336
688.12	4592.8267	22017.91	163746.39	0.1525773	772	2319.3	20196.047	155101.26	0.0710472
689.75	4525.05	21843.587	163506.8	0.150384	773.57	2328.2833	20272.07	155740.33	0.0710323
691.38	4502.29	21983.117	164842.04	0.1481494	775.14	2337.0033	20289.517	155905.34	0.0712888
693.02	4503.28	22356.787	167066.87	0.1458202	776.7	2336.55	20242.623	155840.47	0.0713531
694.65	4426.07	22310.31	166819.91	0.1431771	778.27	2330.69	20178.123	155612.17	0.0712941
696.29	4276.87	21907.367	164703.94	0.1397551	779.83	2327.5233	20101.92	155371.65	0.0713627
697.92	4160.8067	21705.743	163979.19	0.1361419	781.4	2325.7433	20018.15	155049.56	0.0715339
699.55	4106.8033	21920.763	165381.05	0.1327075	782.96	2314.82	19859.25	154504.74	0.0715229
701.19	4063.1367	22220.923	167376.22	0.1291709	784.51	2293.3067	19618.287	153428.02	0.0714201
702.82	4002.5433	22417.037	168730.6	0.1256732	786.07	2247.7733	19287.36	151715.42	0.0707243

787.62	2198.07	18792.49	149158.99	0.0704264	865.69	1683.7633	14603.547	123707.84	0.064751
789.17	2142.28	18355.023	146851.06	0.0696703	867.15	1703.4967	14674.92	124989.84	0.0649784
790.72	2123.1933	18119.013	145366.25	0.0698426	868.62	1733.8133	14933.15	126968.64	0.0651082
792.27	2118.3967	18068.763	144824.33	0.0699569	870.08	1751.2033	14969.54	127617.27	0.0655833
793.81	2129.7533	18037.333	144563.66	0.0706149	871.54	1753.0667	14966.65	127356.35	0.0658135
795.35	2121.1667	17893.207	144208.69	0.0705904	873	1738.8733	14896.643	126774.25	0.0655094
796.89	2105.4267	17776.05	143972.85	0.0701623	874.46	1736.3567	14810.6	126410.13	0.0656928
798.43	2104.9033	17695.063	143838.99	0.0703037	875.91	1732.34	14763.677	126133.34	0.0657023
799.97	2085.1467	17509.55	142749.95	0.0701991	877.37	1720.1433	14671.957	125542.58	0.0655296
801.5	2062.21	17270.923	141577.72	0.070059	878.83	1711.3533	14540.583	124501.03	0.0658198
803.03	2050.58	17180.26	141139.41	0.0698718	880.29	1694.77	14435.533	124031.24	0.0653781
804.56	2074.7433	17246.533	141710.49	0.0705793	881.74	1675.3733	14440.75	124056.78	0.0643748
806.09	2097.6533	17376.72	142277.11	0.071149	883.2	1682.8067	14345.427	123398.19	0.0652328
807.61	2074.8433	17265.947	141454.56	0.0706873	884.66	1658.51	14142.73	122256.36	0.064885
809.14	2022.28	16778.687	138667.23	0.0703447	886.11	1646.11	14112.117	121712.46	0.0645791
810.66	1921.6	16049.09	133932.86	0.0690664	887.57	1636.79	13967.293	121506.27	0.0644164
812.17	1780.3933	14959.327	126481.68	0.0676363	889.03	1604.8733	13807.94	119976.27	0.0638001
813.69	1605.6433	13576.627	116911.61	0.065862	890.48	1527.4967	13237.52	116018.82	0.0626509
815.21	1461.3733	12398.977	108656.87	0.0644298	891.94	1410.5733	12294.713	109449.89	0.0612143
816.72	1388.2067	11798.157	104904.71	0.0633596	893.39	1264.39	11146.297	100630.89	0.0594593
818.23	1406.0067	11915.64	106195.39	0.0634481	894.85	1116.3533	9984.7367	91635.807	0.0573755
819.74	1472.8567	12474.01	110113.57	0.0641128	896.31	1012.1167	9096.29	84936.097	0.0560305
821.25	1486.0867	12634.25	110646.19	0.0643007	897.76	960.33667	8589.6067	80934.137	0.0558826
822.75	1457.0867	12419.677	109091.48	0.0638928	899.22	949.82667	8525.7933	81218.8	0.0550119
824.25	1484.7333	12724.367	112217.83	0.0631831	900.68	1017.3967	9026.0033	86342.787	0.0556451
825.75	1543.6733	13338.977	116539.11	0.0630902	902.14	1098.59	9795.5	92425.937	0.0560376
827.25	1535.4233	13279.237	116206.34	0.0629152	903.59	1107.1233	9894.2833	92171.853	0.0565853
828.75	1496.44	13103.98	114883.16	0.0617761	905.05	1025.1733	9121.6933	85893.013	0.0563094
830.25	1494.5	13167.963	115416.03	0.0612878	906.51	927.68667	8413.4	80536.797	0.053996
831.74	1508.9833	13346.567	116718.73	0.0611142	907.97	902.06	8196.63	79025.843	0.0534734
833.23	1543.3967	13634.267	118999.88	0.0613344	909.43	892.83	8094.9967	78594.157	0.0532568
834.72	1594.7067	14100.357	122234.98	0.0616777	910.89	859.79	7885.6633	76533.9	0.0524591
836.21	1651.32	14566.52	125403.6	0.0623018	912.35	830.90667	7614.7567	74633.82	0.0520017
837.7	1696.4533	14895.67	127959.85	0.0628209	913.82	825.48	7520.2867	74407.69	0.0519248
839.18	1731.74	15173.89	129767.37	0.0632772	915.28	863.75333	7766.8767	76549.34	0.0530469
840.67	1754.7533	15433.387	131139.58	0.0633696	916.74	921.10667	8375.01	81567.777	0.0528895
842.15	1776.7	15571.913	131868.93	0.06388	918.21	999.01333	9007.4233	86216.003	0.0544251
843.63	1791.87	15677.89	132433.08	0.0641868	919.68	1009.4167	9079.1733	86642.54	0.0547659
845.11	1815.11	15800.503	133143.89	0.0647788	921.14	967.92	8848.4667	84872.143	0.0533145
846.59	1821.9267	15822.89	133005.63	0.0651386	922.61	935.97	8610.9367	83020.65	0.0525888
848.07	1793.8267	15647.05	131242.79	0.0649039	924.08	900.02667	8253.89	79377.813	0.0529485
849.54	1762.0433	15355.68	129303.17	0.0647295	925.55	766.03333	7209.7033	70114.34	0.0505565
851.02	1722.7933	15158.057	127578.59	0.063944	927.02	613.11333	5828.7767	57481.517	0.0491785
852.49	1691.7067	14853.897	124901.79	0.064179	928.49	493.69	4596.3033	45635.32	0.0502532
853.96	1660.5733	14617.327	123323.78	0.0637515	929.97	386.01667	3558.4367	35211.667	0.0511019
855.43	1699.24	14916.043	126090.64	0.0638626	931.44	335.69333	2868.2267	28791.893	0.0557316
856.9	1754.5933	15265.493	129426.57	0.0644287	932.92	294.99333	2631.5267	26895.9	0.0517006
858.37	1761.2133	15430.927	130492.24	0.0639983	934.4	311.33667	2643.94	27531.483	0.0541576
859.83	1772.9333	15421.967	130665.81	0.0644889	935.88	346.01667	3021.5433	32164.833	0.0510654
861.3	1761.13	15448.503	130756.12	0.0638415	937.36	383.62667	3494.7367	37778.797	0.0475285
862.76	1761.03	15326.12	129507.7	0.0646183	938.84	412.38333	3560.5667	38100.03	0.0515662
864.23	1718.9333	14912.813	126050.7	0.064869	940.32	373.28	3398.1567	35896.883	0.0486826

941.81	357.25	3278.2867	34127.78	0.0488728	1016.2	1343.4733	11227.603	100568.6	0.0642947
943.29	351.26333	3185.5433	33657.35	0.0489231	1017.74	1392.44	11239.587	100389.19	0.0674534
944.78	365.67333	3241.9667	34471.813	0.0501058	1019.27	1335.45	11307.963	100384.22	0.0637698
946.27	372.33	3323.18	35610.28	0.0492772	1020.8	1355.61	11350.993	100785.26	0.0646977
947.76	398.11333	3410.8	36299.06	0.0523804	1022.33	1444.3167	11327.963	100516.79	0.0704558
949.25	376.63333	3461.5733	36616.763	0.0479962	1023.86	1414.0167	11076.473	101102.26	0.0686024
950.74	376.91667	3506.2133	36932.127	0.0474219	1025.39	1387.4767	11305.363	100802.73	0.0667525
952.24	403.38667	3535.5667	37989.56	0.0503439	1026.91	1443.6933	11549.557	100438.37	0.0700837
953.74	424.80333	3747.91	39696.527	0.0506279	1028.44	1428.6967	11563.497	100901.57	0.0688038
955.23	456.43667	3957.8067	41538.56	0.0522787	1029.96	1483.5133	11774.647	101579.68	0.0713694
956.73	453.01333	4083.3133	42521.067	0.0500456	1031.48	1391.2533	11520.563	101537.18	0.0661304
958.24	481.97667	4196.0233	44505.57	0.0514575	1033	1492.4333	11684.363	101434.57	0.0721807
959.74	476.36	4578.1433	48006.59	0.0455694	1034.51	1556.6533	11708.167	101115.98	0.0763572
961.24	538.23667	4889.51	51099.95	0.0493471	1036.02	1530.7433	11856.29	101975.26	0.0738618
962.75	568.99	5130.7967	53518.157	0.0499347	1037.53	1451.9767	11906.19	101522.05	0.0692302
964.26	631.73	5775.8267	58881.33	0.0501541	1039.03	1564.9633	11668.83	102223.82	0.0761082
965.77	737.57667	6604.3433	67396.78	0.0515223	1040.54	1513.73	11791.163	103762.27	0.0716699
967.28	828.86333	7373.7733	73875.29	0.0529357	1042.03	1592.8967	12145.83	102741.78	0.0766159
968.79	851.03333	7812.78	76425.71	0.0519813	1043.53	1528.2033	11808.817	103500.79	0.0726996
970.3	829.66667	7701.02	75648.707	0.0510004	1045.02	1637.54	12154.17	103201.27	0.0789786
971.82	830.45333	7308.01	72589.067	0.0541707	1046.5	1536.61	12216.977	105020.48	0.0714668
973.34	805.34	7281.1467	71928.877	0.0525399	1047.98	1563.5133	12508.1	104973.03	0.0726215
974.85	810.90333	7294.3833	73153.127	0.0521066	1049.46	1696.3733	13074.46	104926.67	0.0796599
976.37	855.04	7676.3467	75547.373	0.0532365	1050.93	1683.2267	12171.023	104964.29	0.0803586
977.9	891.03667	7887.5967	77791.247	0.0541306	1052.39	1619.2133	12503.907	106508.1	0.0748677
979.42	924.27667	8358.0033	81368.067	0.0533008	1053.85	1795.15	13321.883	107141.96	0.0833992
980.94	1005.5967	8817.0767	84598.88	0.0563503	1055.3	1746.69	13087.873	106867.91	0.0811491
982.47	1074.6167	9138.3633	87971.133	0.0584773	1056.75	1736.9667	13180.487	107283.03	0.0801138
983.99	1117.7133	9611.51	90991.2	0.0585975	1058.19	1634.1067	13180.023	108440.5	0.0732996
985.52	1128.7333	9970.49	93171.92	0.0572913	1059.62	1801.5533	12971.203	108204.23	0.0835224
987.05	1159.2967	10219.317	95018.62	0.0577382	1061.05	1835.58	13169.557	106755	0.0863321
988.58	1191.3133	10265.01	96165.09	0.0590581	1062.46	1889.3167	13529.963	109458.61	0.086705
990.11	1228.0667	10557.71	97512.16	0.0600824	1063.87	1876.8333	13742.22	110955.68	0.0844917
991.64	1220.2667	10760.983	97621.517	0.0591467	1065.27	1855.4433	13915.833	111326.66	0.0827285
993.17	1255.1767	10813.833	98907.96	0.0605011	1066.67	1902.43	13996.457	111699.89	0.0849682
994.71	1299.22	11048.343	99494.56	0.0625111	1068.05	2086.7267	12659.47	111292.07	0.0977978
996.24	1289.2533	10843.997	99512.027	0.0622321	1069.42	1816.9333	13537.94	111723.66	0.0808639
997.77	1313.62	10950.337	99835.13	0.0633768	1070.79	1985.2067	14293.493	112904.16	0.0882056
999.31	1284.21	10985.937	99413.013	0.0617241	1072.14	1929.5	13834.153	111255.71	0.0870928
1000.85	1273.1733	10833.123	99083.983	0.0615006	1073.48	1872.8567	15129.747	112518.31	0.0809268
1002.38	1298.1267	10915.803	98403.763	0.0633712	1074.82	2096.6667	13683.507	114470.62	0.094054
1003.92	1261.8233	10761.203	97707.933	0.0617663	1076.14	1994.3533	13443.44	112570.36	0.0903062
1005.45	1307.5833	10904.757	98488.22	0.0639399	1077.44	2039.58	13498.303	113326.42	0.092126
1006.99	1302.46	10853.843	98629.523	0.0636127	1078.74	2105.3267	13835.027	111582.49	0.0967372
1008.53	1275.5333	11076.64	98605.88	0.0615147	1080.02	2375.2567	13945.057	112786.38	0.1105704
1010.06	1325.3967	10987.727	99878.443	0.0640243	1081.3	1943.7267	13683.853	112580.79	0.0870966
1011.6	1326.71	11013.133	99802.93	0.0641107	1082.55	2373.3833	14398.533	107276.97	0.1153956
1013.13	1347.2833	11281.663	100320.91	0.0645973					
1014.67	1385.5533	11022.83	99882.89	0.0677438					

APPENDIX F

LOCAL CLIMATE DATA

LUIS MUÑOZ AIRPORT

JUNE-AUGUST, 1995

FEBRUARY, MAY, AND AUGUST, 2006

Preliminary Local Climatological Data

San Juan Area
Daily Data Listing
Jan 1, 1995 - Dec 31, 1995

Date	MaxT	MinT	Pcpn	Snow	Snwg
01/01/1995	84	71	0.63	0.0	0
01/02/1995	84	73	0.06	0.0	0
01/03/1995	84	71	0.24	0.0	0
01/04/1995	86	71	0.03	0.0	0
01/05/1995	86	71	0.00	0.0	0
01/06/1995	86	72	0.00	0.0	0
01/07/1995	85	72	T	0.0	0
01/08/1995	86	71	0.01	0.0	0
01/09/1995	84	72	0.13	0.0	0
01/10/1995	83	70	0.42	0.0	0
01/11/1995	83	71	T	0.0	0
01/12/1995	82	71	0.26	0.0	0
01/13/1995	83	68	0.33	0.0	0
01/14/1995	83	72	0.11	0.0	0
01/15/1995	83	71	0.02	0.0	0
01/16/1995	84	68	0.00	0.0	0
01/17/1995	85	69	0.00	0.0	0
01/18/1995	88	70	0.39	0.0	0
01/19/1995	87	71	T	0.0	0
01/20/1995	87	71	0.00	0.0	0
01/21/1995	91	71	0.00	0.0	0
01/22/1995	87	72	0.00	0.0	0
01/23/1995	85	72	T	0.0	0
01/24/1995	89	72	T	0.0	0
01/25/1995	87	73	T	0.0	0
01/26/1995	78	71	0.10	0.0	0
01/27/1995	81	71	0.25	0.0	0
01/28/1995	83	71	0.71	0.0	0
01/29/1995	88	71	0.00	0.0	0
01/30/1995	85	70	0.00	0.0	0
01/31/1995	89	71	0.00	0.0	0
02/01/1995	86	68	0.00	0.0	0
02/02/1995	87	71	0.00	0.0	0
02/03/1995	85	70	0.00	0.0	0
02/04/1995	86	70	0.00	0.0	0
02/05/1995	91	70	0.00	0.0	0
02/06/1995	89	72	0.00	0.0	0
02/07/1995	85	70	0.09	0.0	0
02/08/1995	88	69	T	0.0	0
02/09/1995	90	72	0.00	0.0	0
02/10/1995	86	76	0.00	0.0	0

02/11/1995	87	74	0.02	0.0	0
02/12/1995	90	72	0.00	0.0	0
02/13/1995	88	72	0.00	0.0	0
02/14/1995	89	74	T	0.0	0
02/15/1995	85	73	0.20	0.0	0
02/16/1995	85	72	0.11	0.0	0
02/17/1995	85	71	0.07	0.0	0
02/18/1995	84	72	0.26	0.0	0
02/19/1995	83	72	0.30	0.0	0
02/20/1995	86	71	0.22	0.0	0
02/21/1995	85	71	0.79	0.0	0
02/22/1995	87	68	0.00	0.0	0
02/23/1995	83	69	0.00	0.0	0
02/24/1995	85	69	0.00	0.0	0
02/25/1995	87	70	1.18	0.0	0
02/26/1995	84	70	0.01	0.0	0
02/27/1995	84	72	0.05	0.0	0
02/28/1995	82	73	0.27	0.0	0
03/01/1995	84	70	0.01	0.0	0
03/02/1995	84	71	0.05	0.0	0
03/03/1995	85	71	0.00	0.0	0
03/04/1995	84	72	0.31	0.0	0
03/05/1995	86	72	0.00	0.0	0
03/06/1995	85	72	0.02	0.0	0
03/07/1995	84	73	0.34	0.0	0
03/08/1995	83	71	0.18	0.0	0
03/09/1995	84	72	0.02	0.0	0
03/10/1995	89	70	0.00	0.0	0
03/11/1995	86	72	T	0.0	0
03/12/1995	82	72	0.00	0.0	0
03/13/1995	77	70	0.11	0.0	0
03/14/1995	82	69	0.06	0.0	0
03/15/1995	82	69	0.03	0.0	0
03/16/1995	82	66	0.00	0.0	0
03/17/1995	82	70	0.00	0.0	0
03/18/1995	82	67	0.00	0.0	0
03/19/1995	88	69	0.00	0.0	0
03/20/1995	89	71	0.00	0.0	0
03/21/1995	86	73	0.01	0.0	0
03/22/1995	85	72	0.00	0.0	0
03/23/1995	84	69	0.00	0.0	0
03/24/1995	85	68	0.00	0.0	0
03/25/1995	86	69	0.00	0.0	0
03/26/1995	85	70	0.00	0.0	0
03/27/1995	80	72	0.15	0.0	0
03/28/1995	83	67	0.00	0.0	0
03/29/1995	84	68	0.00	0.0	0

03/30/1995	85	72	0.00	0.0	0
03/31/1995	85	71	0.00	0.0	0
04/01/1995	90	70	0.00	0.0	0
04/02/1995	91	74	0.00	0.0	0
04/03/1995	90	73	0.00	0.0	0
04/04/1995	86	76	0.00	0.0	0
04/05/1995	84	74	T	0.0	0
04/06/1995	90	73	T	0.0	0
04/07/1995	91	75	T	0.0	0
04/08/1995	90	73	0.00	0.0	0
04/09/1995	88	74	0.00	0.0	0
04/10/1995	88	74	T	0.0	0
04/11/1995	87	77	0.02	0.0	0
04/12/1995	86	77	0.05	0.0	0
04/13/1995	84	73	0.18	0.0	0
04/14/1995	86	70	0.00	0.0	0
04/15/1995	91	71	2.25	0.0	0
04/16/1995	86	73	0.00	0.0	0
04/17/1995	86	73	0.33	0.0	0
04/18/1995	86	77	0.00	0.0	0
04/19/1995	86	76	0.00	0.0	0
04/20/1995	84	72	T	0.0	0
04/21/1995	85	73	0.04	0.0	0
04/22/1995	84	74	0.00	0.0	0
04/23/1995	85	71	0.00	0.0	0
04/24/1995	88	71	0.00	0.0	0
04/25/1995	89	74	0.07	0.0	0
04/26/1995	87	74	0.00	0.0	0
04/27/1995	86	73	0.04	0.0	0
04/28/1995	89	72	0.00	0.0	0
04/29/1995	93	73	0.00	0.0	0
04/30/1995	94	75	0.00	0.0	0
05/01/1995	94	76	0.00	0.0	0
05/02/1995	94	76	0.00	0.0	0
05/03/1995	90	75	0.00	0.0	0
05/04/1995	88	77	0.00	0.0	0
05/05/1995	87	78	T	0.0	0
05/06/1995	88	74	1.15	0.0	0
05/07/1995	87	73	0.02	0.0	0
05/08/1995	86	75	0.00	0.0	0
05/09/1995	85	76	0.00	0.0	0
05/10/1995	86	77	0.00	0.0	0
05/11/1995	86	77	0.01	0.0	0
05/12/1995	86	74	0.00	0.0	0
05/13/1995	88	74	0.04	0.0	0
05/14/1995	87	75	T	0.0	0
05/15/1995	85	71	3.95	0.0	0

	05/16/1995	86	72	0.02	0.0	0
	05/17/1995	87	74	T	0.0	0
	05/18/1995	88	77	0.80	0.0	0
	05/19/1995	87	74	1.63	0.0	0
	05/20/1995	87	73	1.09	0.0	0
	05/21/1995	89	75	0.30	0.0	0
	05/22/1995	89	76	0.00	0.0	0
	05/23/1995	92	76	0.00	0.0	0
	05/24/1995	90	78	0.07	0.0	0
	05/25/1995	88	76	T	0.0	0
	05/26/1995	87	75	0.08	0.0	0
	05/27/1995	87	74	0.11	0.0	0
	05/28/1995	87	74	T	0.0	0
	05/29/1995	88	74	0.10	0.0	0
	05/30/1995	88	75	T	0.0	0
0.31	05/31/1995	88	75	0.10	0.0	0
	06/01/1995	88	76	0.12	0.0	0
	06/02/1995	88	73	1.13	0.0	0
	06/03/1995	86	74	0.02	0.0	0
1.30	06/04/1995	88	75	0.03	0.0	0
	06/05/1995	87	75	0.00	0.0	0
	06/06/1995	87	75	0.27	0.0	0
	06/07/1995	88	75	0.29	0.0	0
	06/08/1995	90	76	0.00	0.0	0
	06/09/1995	88	77	0.00	0.0	0
1.60	06/10/1995	88	73	1.04	0.0	0
	06/11/1995	89	74	0.06	0.0	0
	06/12/1995	91	77	0.05	0.0	0
	06/13/1995	92	76	0.00	0.0	0
0.35	06/14/1995	89	77	0.00	0.0	0
	06/15/1995	89	76	0.24	0.0	0
	06/16/1995	90	77	0.01	0.0	0
	06/17/1995	90	78	0.13	0.0	0
	06/18/1995	92	79	0.00	0.0	0
0.27	06/19/1995	92	78	0.03	0.0	0
	06/20/1995	90	78	0.10	0.0	0
	06/21/1995	92	80	0.00	0.0	0
	06/22/1995	90	81	0.00	0.0	0
	06/23/1995	93	80	0.01	0.0	0
0.01	06/24/1995	89	79	0.00	0.0	0
	06/25/1995	89	78	0.00	0.0	0
	06/26/1995	89	76	0.51	0.0	0
	06/27/1995	90	79	0.00	0.0	0
	06/28/1995	93	78	T	0.0	0
1.13	06/29/1995	94	77	0.00	0.0	0
	06/30/1995	93	77	0.62	0.0	0
	07/01/1995	94	79	0.00	0.0	0

	07/02/1995	93	80	0.00	0.0	0
	07/03/1995	90	78	0.01	0.0	0
	07/04/1995	90	77	0.05	0.0	0
0.83	07/05/1995	90	78	0.00	0.0	0
	07/06/1995	90	76	0.69	0.0	0
	07/07/1995	91	77	T	0.0	0
	07/08/1995	94	78	0.01	0.0	0
	07/09/1995	93	80	0.01	0.0	0
0.71	07/10/1995	93	79	0.00	0.0	0
	07/11/1995	90	77	0.24	0.0	0
	07/12/1995	89	77	0.18	0.0	0
	07/13/1995	90	79	T	0.0	0
1.2	07/14/1995	93	77	0.75	0.0	0
	07/15/1995	90	77	0.03	0.0	0
	07/16/1995	93	80	0.00	0.0	0
	07/17/1995	93	79	0.00	0.0	0
	07/18/1995	83	75	0.02	0.0	0
	07/19/1995	91	79	0.00	0.0	0
0.05	07/20/1995	92	78	0.03	0.0	0
	07/21/1995	90	76	0.75	0.0	0
	07/22/1995	90	77	0.01	0.0	0
	07/23/1995	89	77	0.87	0.0	0
	07/24/1995	90	80	0.02	0.0	0
1.65	07/25/1995	91	79	T	0.0	0
	07/26/1995	91	79	0.03	0.0	0
	07/27/1995	82	75	0.90	0.0	0
	07/28/1995	88	77	0.25	0.0	0
	07/29/1995	92	77	T	0.0	0
1.18	07/30/1995	91	79	0.00	0.0	0
	07/31/1995	93	77	0.00	0.0	0
	08/01/1995	90	77	0.68	0.0	0
	08/02/1995	89	78	0.14	0.0	0
0.97	08/03/1995	89	74	0.15	0.0	0
	08/04/1995	90	82	0.00	0.0	0
	08/05/1995	89	79	0.00	0.0	0
	08/06/1995	93	78	0.01	0.0	0
	08/07/1995	92	78	0.09	0.0	0
0.28	08/08/1995	94	79	0.09	0.0	0
	08/09/1995	92	79	0.09	0.0	0
	08/10/1995	91	80	0.00	0.0	0
	08/11/1995	92	83	0.00	0.0	0
	08/12/1995	92	82	T	0.0	0
0.16	08/13/1995	92	78	0.00	0.0	0
	08/14/1995	94	78	0.16	0.0	0
	08/15/1995	92	76	0.54	0.0	0
	08/16/1995	91	79	0.00	0.0	0
	08/17/1995	89	78	0.49	0.0	0

2.53	08/18/1995	87	74	1.07	0.0	0
	08/19/1995	89	74	0.43	0.0	0
	08/20/1995	91	76	0.07	0.0	0
	08/21/1995	91	77	T	0.0	0
	08/22/1995	89	77	0.00	0.0	0
	08/23/1995	90	78	0.18	0.0	0
0.25	08/24/1995	89	80	T	0.0	0
	08/25/1995	90	76	0.09	0.0	0
	08/26/1995	90	80	0.03	0.0	0
	08/27/1995	90	80	0.20	0.0	0
0.32	08/28/1995	90	82	0.00	0.0	0
	08/29/1995	92	78	0.00	0.0	0
	08/30/1995	91	79	0.09	0.0	0
	08/31/1995	94	75	0.55	0.0	0
	09/01/1995	93	76	0.07	0.0	0
	09/02/1995	93	78	0.04	0.0	0
	09/03/1995	93	80	0.00	0.0	0
	09/04/1995	90	80	0.05	0.0	0
	09/05/1995	90	77	0.19	0.0	0
	09/06/1995	85	76	2.12	0.0	0
	09/07/1995	95	77	0.11	0.0	0
	09/08/1995	95	82	0.00	0.0	0
	09/09/1995	94	80	0.00	0.0	0
	09/10/1995	91	77	0.23	0.0	0
	09/11/1995	91	78	0.39	0.0	0
	09/12/1995	91	80	0.05	0.0	0
	09/13/1995	91	79	0.13	0.0	0
	09/14/1995	92	80	0.07	0.0	0
	09/15/1995	91	77	0.93	0.0	0
	09/16/1995	84	77	1.59	0.0	0
	09/17/1995	95	79	0.03	0.0	0
	09/18/1995	96	81	0.00	0.0	0
	09/19/1995	93	79	0.03	0.0	0
	09/20/1995	94	80	0.01	0.0	0
	09/21/1995	91	79	T	0.0	0
	09/22/1995	92	78	0.44	0.0	0
	09/23/1995	91	78	0.04	0.0	0
	09/24/1995	93	81	0.00	0.0	0
	09/25/1995	93	80	T	0.0	0
	09/26/1995	86	77	0.03	0.0	0
	09/27/1995	88	77	0.12	0.0	0
	09/28/1995	89	77	0.17	0.0	0
	09/29/1995	89	77	0.21	0.0	0
	09/30/1995	90	76	0.12	0.0	0
	10/01/1995	89	76	0.00	0.0	0
	10/02/1995	89	75	1.15	0.0	0
	10/03/1995	89	76	0.01	0.0	0

10/04/1995	90	76	T	0.0	0
10/05/1995	90	76	T	0.0	0
10/06/1995	90	79	T	0.0	0
10/07/1995	89	78	0.26	0.0	0
10/08/1995	89	77	0.30	0.0	0
10/09/1995	88	76	0.16	0.0	0
10/10/1995	83	76	0.89	0.0	0
10/11/1995	88	76	0.47	0.0	0
10/12/1995	88	76	0.11	0.0	0
10/13/1995	89	77	0.00	0.0	0
10/14/1995	89	76	0.03	0.0	0
10/15/1995	90	75	0.04	0.0	0
10/16/1995	93	74	T	0.0	0
10/17/1995	87	75	0.46	0.0	0
10/18/1995	89	74	0.17	0.0	0
10/19/1995	86	74	1.15	0.0	0
10/20/1995	87	74	0.07	0.0	0
10/21/1995	90	75	0.08	0.0	0
10/22/1995	89	76	0.07	0.0	0
10/23/1995	88	77	0.09	0.0	0
10/24/1995	89	78	0.29	0.0	0
10/25/1995	89	77	T	0.0	0
10/26/1995	93	74	0.24	0.0	0
10/27/1995	89	74	0.00	0.0	0
10/28/1995	89	75	0.00	0.0	0
10/29/1995	88	76	0.00	0.0	0
10/30/1995	88	75	T	0.0	0
10/31/1995	89	76	0.03	0.0	0
11/01/1995	88	76	0.43	0.0	0
11/02/1995	86	75	0.43	0.0	0
11/03/1995	87	74	0.28	0.0	0
11/04/1995	87	75	0.03	0.0	0
11/05/1995	87	74	0.61	0.0	0
11/06/1995	86	74	0.30	0.0	0
11/07/1995	87	75	T	0.0	0
11/08/1995	87	75	0.00	0.0	0
11/09/1995	88	74	0.00	0.0	0
11/10/1995	87	76	0.00	0.0	0
11/11/1995	87	74	0.02	0.0	0
11/12/1995	87	74	0.09	0.0	0
11/13/1995	88	73	0.00	0.0	0
11/14/1995	90	73	0.00	0.0	0
11/15/1995	88	75	0.14	0.0	0
11/16/1995	87	75	0.08	0.0	0
11/17/1995	86	75	0.01	0.0	0
11/18/1995	87	74	T	0.0	0
11/19/1995	88	76	T	0.0	0

11/20/1995	88	74	0.00	0.0	0
11/21/1995	88	75	0.00	0.0	0
11/22/1995	82	74	0.00	0.0	0
11/23/1995	89	75	0.00	0.0	0
11/24/1995	84	75	0.43	0.0	0
11/25/1995	86	73	0.04	0.0	0
11/26/1995	87	74	0.03	0.0	0
11/27/1995	88	73	0.03	0.0	0
11/28/1995	87	76	0.12	0.0	0
11/29/1995	87	75	0.02	0.0	0
11/30/1995	88	72	T	0.0	0
12/01/1995	88	72	0.00	0.0	0
12/02/1995	87	74	0.25	0.0	0
12/03/1995	87	74	0.08	0.0	0
12/04/1995	88	73	0.12	0.0	0
12/05/1995	87	72	0.03	0.0	0
12/06/1995	87	73	0.12	0.0	0
12/07/1995	86	74	0.00	0.0	0
12/08/1995	86	74	0.05	0.0	0
12/09/1995	86	75	0.18	0.0	0
12/10/1995	86	74	0.39	0.0	0
12/11/1995	86	73	0.05	0.0	0
12/12/1995	85	73	0.17	0.0	0
12/13/1995	86	73	0.16	0.0	0
12/14/1995	84	73	0.09	0.0	0
12/15/1995	85	72	0.01	0.0	0
12/16/1995	84	74	0.08	0.0	0
12/17/1995	81	73	0.60	0.0	0
12/18/1995	80	73	1.01	0.0	0
12/19/1995	85	73	0.03	0.0	0
12/20/1995	90	74	0.00	0.0	0
12/21/1995	89	74	0.33	0.0	0
12/22/1995	89	72	0.00	0.0	0
12/23/1995	90	73	T	0.0	0
12/24/1995	91	73	0.00	0.0	0
12/25/1995	89	74	0.00	0.0	0
12/26/1995	89	74	T	0.0	0
12/27/1995	86	74	0.09	0.0	0
12/28/1995	86	76	0.00	0.0	0
12/29/1995	85	73	T	0.0	0
12/30/1995	85	77	0.00	0.0	0
12/31/1995	87	72	0.00	0.0	0

Daily Data Listing

Jan 1, 2006 - Dec 31, 2006

Date	MaxT	MinT	Pcpn	Snow	Snwd
01/01/2006	81	71	0.11	0.0	0
01/02/2006	82	73	0.09	0.0	0
01/03/2006	82	69	0.03	0.0	0
01/04/2006	81	68	0.00	0.0	0
01/05/2006	81	70	0.00	0.0	0
01/06/2006	81	66	0.00	0.0	0
01/07/2006	82	69	0.00	0.0	0
01/08/2006	82	69	0.00	0.0	0
01/09/2006	81	73	0.83	0.0	0
01/10/2006	82	73	0.33	0.0	0
01/11/2006	81	70	0.58	0.0	0
01/12/2006	81	72	0.26	0.0	0
01/13/2006	82	71	0.09	0.0	0
01/14/2006	84	70	0.00	0.0	0
01/15/2006	87	69	2.69	0.0	0
01/16/2006	78	70	0.03	0.0	0
01/17/2006	80	69	0.00	0.0	0
01/18/2006	81	73	0.08	0.0	0
01/19/2006	81	71	0.26	0.0	0
01/20/2006	80	71	0.26	0.0	0
01/21/2006	80	72	0.07	0.0	0
01/22/2006	79	72	0.45	0.0	0
01/23/2006	81	69	0.03	0.0	0
01/24/2006	80	66	T	0.0	0
01/25/2006	84	68	0.00	0.0	0
01/26/2006	80	68	0.04	0.0	0
01/27/2006	80	69	0.10	0.0	0
01/28/2006	75	70	0.05	0.0	0
01/29/2006	77	69	0.10	0.0	0
01/30/2006	81	70	0.01	0.0	0
01/31/2006	81	69	0.00	0.0	0
02/01/2006	83	67	0.00	0.0	0
02/02/2006	76	68	0.62	0.0	0
02/03/2006	81	69	0.09	0.0	0
02/04/2006	81	69	T	0.0	0
02/05/2006	83	72	T	0.0	0
02/06/2006	81	71	0.34	0.0	0
02/07/2006	80	70	0.24	0.0	0
02/08/2006	81	71	0.19	0.0	0
02/09/2006	85	69	0.00	0.0	0
02/10/2006	81	70	T	0.0	0
02/11/2006	82	72	0.16	0.0	0

	02/12/2006	84	71	0.00	0.0	0
	02/13/2006	87	68	0.00	0.0	0
	02/14/2006	84	71	T	0.0	0
	02/15/2006	82	71	0.07	0.0	0
	02/16/2006	83	73	T	0.0	0
	02/17/2006	83	70	T	0.0	0
	02/18/2006	81	70	0.02	0.0	0
	02/19/2006	82	70	T	0.0	0
	02/20/2006	82	72	0.01	0.0	0
	02/21/2006	83	72	T	0.0	0
	02/22/2006	83	71	T	0.0	0
	02/23/2006	83	73	T	0.0	0
0.01	02/24/2006	82	71	0.00	0.0	0
	02/25/2006	83	73	0.00	0.0	0
	02/26/2006	87	70	T	0.0	0
	02/27/2006	83	72	0.00	0.0	0
	02/28/2006	84	70	0.00	0.0	0
	03/01/2006	82	72	0.12	0.0	0
	03/02/2006	86	72	0.00	0.0	0
	03/03/2006	87	73	0.01	0.0	0
	03/04/2006	85	70	0.00	0.0	0
	03/05/2006	83	72	T	0.0	0
	03/06/2006	82	74	T	0.0	0
	03/07/2006	83	72	0.01	0.0	0
	03/08/2006	85	73	T	0.0	0
	03/09/2006	82	74	0.00	0.0	0
	03/10/2006	83	71	0.05	0.0	0
	03/11/2006	84	72	0.00	0.0	0
	03/12/2006	84	72	0.01	0.0	0
	03/13/2006	84	73	0.01	0.0	0
	03/14/2006	83	72	0.29	0.0	0
	03/15/2006	83	71	T	0.0	0
	03/16/2006	84	73	T	0.0	0
	03/17/2006	84	75	T	0.0	0
	03/18/2006	85	72	T	0.0	0
	03/19/2006	84	74	0.00	0.0	0
	03/20/2006	84	72	0.00	0.0	0
	03/21/2006	84	73	T	0.0	0
	03/22/2006	85	73	0.01	0.0	0
	03/23/2006	87	72	0.00	0.0	0
	03/24/2006	84	73	T	0.0	0
	03/25/2006	88	75	0.00	0.0	0
	03/26/2006	91	74	0.00	0.0	0
	03/27/2006	86	75	0.30	0.0	0
	03/28/2006	84	76	T	0.0	0
	03/29/2006	87	75	0.00	0.0	0
	03/30/2006	81	73	0.05	0.0	0

	03/31/2006	81	72	0.71	0.0	0
	04/01/2006	81	70	2.14	0.0	0
	04/02/2006	82	70	0.41	0.0	0
	04/03/2006	84	73	0.02	0.0	0
	04/04/2006	85	73	1.24	0.0	0
	04/05/2006	83	72	0.59	0.0	0
	04/06/2006	82	73	0.04	0.0	0
	04/07/2006	83	73	0.03	0.0	0
	04/08/2006	84	75	T	0.0	0
	04/09/2006	84	73	T	0.0	0
	04/10/2006	87	73	0.00	0.0	0
	04/11/2006	87	73	T	0.0	0
	04/12/2006	87	74	0.03	0.0	0
	04/13/2006	84	75	T	0.0	0
	04/14/2006	87	75	0.18	0.0	0
	04/15/2006	85	75	T	0.0	0
	04/16/2006	84	76	0.00	0.0	0
	04/17/2006	85	74	0.00	0.0	0
	04/18/2006	87	73	0.00	0.0	0
	04/19/2006	87	73	0.00	0.0	0
	04/20/2006	86	75	0.23	0.0	0
	04/21/2006	84	74	1.53	0.0	0
	04/22/2006	81	73	0.87	0.0	0
	04/23/2006	84	75	0.33	0.0	0
	04/24/2006	85	74	T	0.0	0
	04/25/2006	85	75	T	0.0	0
	04/26/2006	85	73	T	0.0	0
	04/27/2006	82	77	T	0.0	0
	04/28/2006	88	76	0.16	0.0	0
	04/29/2006	85	73	0.00	0.0	0
	04/30/2006	88	72	2.26	0.0	0
	05/01/2006	83	74	0.18	0.0	0
	05/02/2006	82	73	0.53	0.0	0
	05/03/2006	82	72	2.65	0.0	0
	05/04/2006	84	74	T	0.0	0
	05/05/2006	83	75	T	0.0	0
	05/06/2006	83	73	0.00	0.0	0
	05/07/2006	84	74	0.00	0.0	0
	05/08/2006	85	78	0.00	0.0	0
	05/09/2006	86	77	0.22	0.0	0
	05/10/2006	87	76	0.31	0.0	0
0.54	05/11/2006	88	75	0.01	0.0	0
	05/12/2006	92	74	T	0.0	0
	05/13/2006	91	75	0.07	0.0	0
	05/14/2006	88	76	T	0.0	0
	05/15/2006	88	76	T	0.0	0
	05/16/2006	89	76	0.02	0.0	0

05/17/2006	92	77	0.00	0.0	0
05/18/2006	93	79	0.00	0.0	0
05/19/2006	93	77	T	0.0	0
05/20/2006	89	78	0.00	0.0	0
05/21/2006	89	78	T	0.0	0
05/22/2006	93	76	0.00	0.0	0
05/23/2006	93	78	0.00	0.0	0
05/24/2006	90	77	0.00	0.0	0
05/25/2006	90	77	0.00	0.0	0
05/26/2006	90	77	0.00	0.0	0
05/27/2006	91	78	0.00	0.0	0
05/28/2006	88	76	0.87	0.0	0
05/29/2006	87	76	T	0.0	0
05/30/2006	94	76	0.00	0.0	0
05/31/2006	93	77	0.00	0.0	0
06/01/2006	91	77	T	0.0	0
06/02/2006	89	76	0.04	0.0	0
06/03/2006	90	77	T	0.0	0
06/04/2006	90	76	0.01	0.0	0
06/05/2006	94	77	T	0.0	0
06/06/2006	93	78	T	0.0	0
06/07/2006	91	78	0.09	0.0	0
06/08/2006	90	77	0.00	0.0	0
06/09/2006	94	78	0.00	0.0	0
06/10/2006	93	78	0.00	0.0	0
06/11/2006	88	74	0.58	0.0	0
06/12/2006	88	77	0.67	0.0	0
06/13/2006	88	75	0.37	0.0	0
06/14/2006	87	76	0.08	0.0	0
06/15/2006	87	77	T	0.0	0
06/16/2006	88	75	0.27	0.0	0
06/17/2006	89	76	0.02	0.0	0
06/18/2006	92	78	0.01	0.0	0
06/19/2006	89	78	0.25	0.0	0
06/20/2006	86	73	1.64	0.0	0
06/21/2006	84	74	0.06	0.0	0
06/22/2006	87	75	0.59	0.0	0
06/23/2006	90	76	0.00	0.0	0
06/24/2006	88	78	T	0.0	0
06/25/2006	91	78	0.00	0.0	0
06/26/2006	92	78	0.00	0.0	0
06/27/2006	90	78	T	0.0	0
06/28/2006	89	77	0.01	0.0	0
06/29/2006	89	73	0.05	0.0	0
06/30/2006	89	76	T	0.0	0
07/01/2006	86	76	0.76	0.0	0
07/02/2006	87	75	0.23	0.0	0

	07/03/2006	89	76	T	0.0	0
	07/04/2006	91	77	0.01	0.0	0
	07/05/2006	90	80	0.00	0.0	0
	07/06/2006	88	79	T	0.0	0
	07/07/2006	87	75	0.12	0.0	0
	07/08/2006	86	73	0.19	0.0	0
	07/09/2006	89	76	0.14	0.0	0
	07/10/2006	85	74	1.57	0.0	0
	07/11/2006	87	77	0.27	0.0	0
	07/12/2006	87	76	0.14	0.0	0
	07/13/2006	86	76	0.51	0.0	0
	07/14/2006	89	76	0.05	0.0	0
	07/15/2006	87	73	0.38	0.0	0
	07/16/2006	88	77	0.00	0.0	0
	07/17/2006	87	75	0.09	0.0	0
	07/18/2006	87	77	0.02	0.0	0
	07/19/2006	93	77	0.01	0.0	0
	07/20/2006	88	75	0.38	0.0	0
	07/21/2006	89	78	0.05	0.0	0
	07/22/2006	90	77	0.06	0.0	0
	07/23/2006	90	78	T	0.0	0
	07/24/2006	89	80	T	0.0	0
	07/25/2006	89	77	0.06	0.0	0
	07/26/2006	85	77	0.61	0.0	0
	07/27/2006	85	77	0.30	0.0	0
	07/28/2006	88	79	0.17	0.0	0
	07/29/2006	87	75	0.70	0.0	0
	07/30/2006	86	73	2.08	0.0	0
	07/31/2006	90	77	0.02	0.0	0
	08/01/2006	88	77	0.00	0.0	0
	08/02/2006	88	76	0.15	0.0	0
	08/03/2006	83	77	0.40	0.0	0
	08/04/2006	87	76	T	0.0	0
	08/05/2006	85	75	0.73	0.0	0
	08/06/2006	87	77	0.11	0.0	0
	08/07/2006	86	78	0.22	0.0	0
	08/08/2006	88	79	T	0.0	0
	08/09/2006	88	80	T	0.0	0
	08/10/2006	86	80	0.04	0.0	0
	08/11/2006	90	80	0.00	0.0	0
	08/12/2006	89	76	0.00	0.0	0
	08/13/2006	88	78	T	0.0	0
0.06	08/14/2006	89	78	0.02	0.0	0
	08/15/2006	89	77	0.06	0.0	0
	08/16/2006	89	76	0.54	0.0	0
	08/17/2006	88	76	0.03	0.0	0
	08/18/2006	87	75	0.58	0.0	0

08/19/2006	87	75	0.00	0.0	0
08/20/2006	89	77	0.00	0.0	0
08/21/2006	90	78	T	0.0	0
08/22/2006	88	78	0.02	0.0	0
08/23/2006	89	81	T	0.0	0
08/24/2006	89	80	T	0.0	0
08/25/2006	88	76	0.59	0.0	0
08/26/2006	84	74	0.59	0.0	0
08/27/2006	87	76	0.13	0.0	0
08/28/2006	88	78	T	0.0	0
08/29/2006	88	78	0.04	0.0	0
08/30/2006	89	77	0.01	0.0	0
08/31/2006	90	77	0.00	0.0	0
09/01/2006	88	76	T	0.0	0
09/02/2006	89	78	0.01	0.0	0
09/03/2006	90	79	0.05	0.0	0
09/04/2006	89	78	0.27	0.0	0
09/05/2006	90	78	0.10	0.0	0
09/06/2006	90	76	0.78	0.0	0
09/07/2006	88	75	0.12	0.0	0
09/08/2006	88	77	T	0.0	0
09/09/2006	90	78	T	0.0	0
09/10/2006	91	76	0.00	0.0	0
09/11/2006	92	78	0.00	0.0	0
09/12/2006	90	78	0.00	0.0	0
09/13/2006	90	75	0.03	0.0	0
09/14/2006	89	77	0.06	0.0	0
09/15/2006	90	78	T	0.0	0
09/16/2006	90	79	0.00	0.0	0
09/17/2006	89	78	0.00	0.0	0
09/18/2006	92	79	0.00	0.0	0
09/19/2006	89	79	T	0.0	0
09/20/2006	89	79	0.00	0.0	0
09/21/2006	89	79	0.00	0.0	0
09/22/2006	91	79	0.16	0.0	0
09/23/2006	90	78	0.05	0.0	0
09/24/2006	91	78	T	0.0	0
09/25/2006	89	77	0.03	0.0	0
09/26/2006	89	76	0.12	0.0	0
09/27/2006	91	76	T	0.0	0
09/28/2006	91	76	T	0.0	0
09/29/2006	90	79	T	0.0	0
09/30/2006	93	78	0.00	0.0	0
10/01/2006	90	78	0.08	0.0	0
10/02/2006	90	76	0.09	0.0	0
10/03/2006	90	77	0.00	0.0	0
10/04/2006	90	77	0.03	0.0	0

10/05/2006	87	77	0.03	0.0	0
10/06/2006	92	77	0.39	0.0	0
10/07/2006	92	78	0.00	0.0	0
10/08/2006	91	79	0.00	0.0	0
10/09/2006	89	75	0.65	0.0	0
10/10/2006	89	76	0.09	0.0	0
10/11/2006	91	75	2.64	0.0	0
10/12/2006	87	75	T	0.0	0
10/13/2006	88	75	0.46	0.0	0
10/14/2006	92	77	1.40	0.0	0
10/15/2006	92	78	0.00	0.0	0
10/16/2006	90	78	0.95	0.0	0
10/17/2006	91	79	0.01	0.0	0
10/18/2006	89	76	1.45	0.0	0
10/19/2006	87	75	0.07	0.0	0
10/20/2006	87	74	1.06	0.0	0
10/21/2006	91	77	0.00	0.0	0
10/22/2006	88	78	0.00	0.0	0
10/23/2006	89	75	0.00	0.0	0
10/24/2006	90	78	T	0.0	0
10/25/2006	89	78	0.00	0.0	0
10/26/2006	88	79	T	0.0	0
10/27/2006	87	77	1.10	0.0	0
10/28/2006	88	78	0.17	0.0	0
10/29/2006	89	78	0.10	0.0	0
10/30/2006	88	78	0.13	0.0	0
10/31/2006	88	78	0.35	0.0	0
11/01/2006	87	76	0.00	0.0	0
11/02/2006	88	76	0.30	0.0	0
11/03/2006	89	78	0.06	0.0	0
11/04/2006	88	77	0.00	0.0	0
11/05/2006	88	77	T	0.0	0
11/06/2006	87	76	0.00	0.0	0
11/07/2006	87	74	T	0.0	0
11/08/2006	89	75	0.02	0.0	0
11/09/2006	89	75	0.00	0.0	0
11/10/2006	87	76	0.00	0.0	0
11/11/2006	86	76	0.24	0.0	0
11/12/2006	86	74	0.30	0.0	0
11/13/2006	84	75	0.17	0.0	0
11/14/2006	86	74	0.01	0.0	0
11/15/2006	85	73	0.02	0.0	0
11/16/2006	85	75	T	0.0	0
11/17/2006	86	74	0.00	0.0	0
11/18/2006	87	74	0.00	0.0	0
11/19/2006	90	74	0.00	0.0	0
11/20/2006	91	76	T	0.0	0

11/21/2006	90	76	T	0.0	0
11/22/2006	88	76	0.13	0.0	0
11/23/2006	87	75	T	0.0	0
11/24/2006	88	74	0.01	0.0	0
11/25/2006	88	75	0.00	0.0	0
11/26/2006	88	75	T	0.0	0
11/27/2006	87	72	3.35	0.0	0
11/28/2006	85	74	0.28	0.0	0
11/29/2006	84	73	0.75	0.0	0
11/30/2006	85	78	0.07	0.0	0
12/01/2006	84	73	0.46	0.0	0
12/02/2006	84	73	0.18	0.0	0
12/03/2006	83	72	0.25	0.0	0
12/04/2006	83	72	0.66	0.0	0
12/05/2006	84	73	0.05	0.0	0
12/06/2006	85	75	T	0.0	0
12/07/2006	86	76	0.13	0.0	0
12/08/2006	86	75	0.00	0.0	0
12/09/2006	86	75	0.01	0.0	0
12/10/2006	85	74	0.08	0.0	0
12/11/2006	84	73	T	0.0	0
12/12/2006	84	73	0.05	0.0	0
12/13/2006	85	73	0.03	0.0	0
12/14/2006	86	73	0.06	0.0	0
12/15/2006	84	72	0.19	0.0	0
12/16/2006	85	73	0.02	0.0	0
12/17/2006	82	75	0.71	0.0	0
12/18/2006	84	73	T	0.0	0
12/19/2006	84	73	0.00	0.0	0
12/20/2006	86	74	0.00	0.0	0
12/21/2006	84	75	0.08	0.0	0
12/22/2006	84	73	0.54	0.0	0
12/23/2006	84	74	0.03	0.0	0
12/24/2006	85	72	0.07	0.0	0
12/25/2006	83	70	0.01	0.0	0
12/26/2006	82	72	0.14	0.0	0
12/27/2006	85	71	0.00	0.0	0
12/28/2006	85	74	0.05	0.0	0
12/29/2006	84	73	0.32	0.0	0
12/30/2006	83	72	0.23	0.0	0
12/31/2006	82	73	0.13	0.0	0

APPENDIX G

USGS SAMPLING SURVEY RESULTS

SAN JUAN BAY ESTUARY

2002-2005

TOTAL PHOSPHORUS

STAID	SNAME	DATES	TIMES	P00665	# P00665 Phosphorus, water, unfiltered, milligrams per liter
20S	50S	10D	10S	9N	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020226	1020	0.12	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020226	1020		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020226	1030	0.12	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020226	1030		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020529	1020	0.02	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020529	1020		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020529	1030	0.02	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020529	1030		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020930	1000	0.06	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020930	1000		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020930	1015	0.06	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20020930	1015		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20030303	1025	0.02	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20030303	1025		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20030303	1035	0.02	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20030303	1035		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20030611	945	0.04	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20030611	945		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20030611	955		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20030611	955		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20031028	920	0.05	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20031028	920		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20031028	930	0.05	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20031028	930		
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040325	1000	0.04	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040325	1000		

50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040325	1015	0.03
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040325	1015	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040527	800	0.03
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040527	800	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040527	815	0.03
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040527	815	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040714	830	0.04
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040714	830	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040714	845	0.04
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040714	845	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040826	840	0.03
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20040826	855	0.039
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20050401	825	
50048610	BAHIA DE SAN JUAN NO. 6, SAN JUAN PR	20050401	840	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20020228	800	0.29
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20020228	800	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20020228	815	0.14
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20020228	815	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20020530	1130	0.17
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20020530	1130	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20020530	1140	0.21
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20020530	1140	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20021002	830	0.17
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20021002	830	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20021002	845	0.16
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20021002	845	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20030305	850	0.22
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20030305	850	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20030305	900	0.22
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20030305	900	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20030612	900	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20030612	900	

50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20030612	910	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20030612	910	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20031030	810	0.37
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20031030	810	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20031030	820	0.38
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20031030	820	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040329	930	0.29
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040329	930	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040329	945	0.34
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040329	945	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040521	915	0.2
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040521	915	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040521	935	0.18
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040521	935	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040715	855	0.14
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040715	855	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040715	915	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040715	915	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040830	920	0.29
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20040830	935	0.842
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20050404	925	
50049720	LAGUNA SAN JOSE NO. 3 AT SAN JUAN, PR	20050404	940	
50049755	SJ5300	20020227	1100	0.14
50049755	SJ5300	20020227	1100	
50049755	SJ5300	20020227	1115	0.15
50049755	SJ5300	20020227	1115	
50049755	SJ5300	20020531	915	0.27
50049755	SJ5300	20020531	915	
50049755	SJ5300	20020531	930	0.27
50049755	SJ5300	20020531	930	
50049755	SJ5300	20021002	915	0.2
50049755	SJ5300	20021002	915	

50049755	SJ5300	20021002	930	0.19
50049755	SJ5300	20021002	930	
50049755	SJ5300	20030305	940	0.21
50049755	SJ5300	20030305	940	
50049755	SJ5300	20030305	950	0.35
50049755	SJ5300	20030305	950	
50049755	SJ5300	20030612	945	
50049755	SJ5300	20030612	945	
50049755	SJ5300	20030612	955	
50049755	SJ5300	20030612	955	
50049755	SJ5300	20031030	905	0.36
50049755	SJ5300	20031030	905	
50049755	SJ5300	20031030	915	0.38
50049755	SJ5300	20040330	840	0.21
50049755	SJ5300	20040330	840	
50049755	SJ5300	20040330	855	0.24
50049755	SJ5300	20040330	855	
50049755	SJ5300	20040521	1100	0.16
50049755	SJ5300	20040521	1100	
50049755	SJ5300	20040521	1125	0.16
50049755	SJ5300	20040521	1125	
50049755	SJ5300	20040720	1015	
50049755	SJ5300	20040720	1015	
50049755	SJ5300	20040720	1030	
50049755	SJ5300	20040720	1030	
50049755	SJ5300	20040831	920	0.18
50049755	SJ5300	20040831	935	0.176
50049755	SJ5300	20050406	1300	
50049755	SJ5300	20050406	1315	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	19991014	1040	0.18
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	19991213	900	0.09
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20000303	900	0.26

50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20000510	930	0.24
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20000912	1050	0.21
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20001113	915	0.18
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20001113	915	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20010307	945	0.23
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20010307	945	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20010619	1055	0.97
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20010619	1055	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20011004	910	0.28
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20011004	910	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20020402	1000	0.26
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20020402	1000	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20021002	800	0.22
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20021002	800	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20021218	930	0.33
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20021218	930	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20030305	915	0.45
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20030305	915	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20030612	920	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20030612	920	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20031030	845	0.41
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20031030	845	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20040329	1010	0.32
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20040329	1010	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20040528	830	0.41
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20040528	830	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20040528	835	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20040715	950	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20040715	950	
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20040830	1000	0.204
50049820	LAGUNA SAN JOSE NO. 2 AT SAN JUAN, PR	20050404	1030	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20020225	1215	0.06

50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20020225	1215	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20020528	1140	0.04
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20020528	1140	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20021007	1005	0.06
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20021007	1005	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20030307	1145	0.18
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20030307	1145	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20030617	1105	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20030617	1105	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20031104	1010	0.06
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20031104	1010	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20040402	1010	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20040402	1010	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20040518	1000	0.04
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20040518	1000	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20040721	1055	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20040721	1055	
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20040827	1115	0.067
50049830	QDA JUAN MENDEZ NR REPARTO UNIVERSITARIO, SAN JUAN	20050407	1120	
50049850	MPN500	20020227	845	0.52
50049850	MPN500	20020227	845	
50049850	MPN500	20020227	850	0.62
50049850	MPN500	20020227	850	
50049850	MPN500	20020530	915	0.68
50049850	MPN500	20020530	915	
50049850	MPN500	20021001	740	0.76
50049850	MPN500	20021001	740	
50049850	MPN500	20030304	830	0.51
50049850	MPN500	20030304	830	
50049850	MPN500	20030610	930	
50049850	MPN500	20030610	930	
50049850	MPN500	20031027	940	0.58

50049850	MPN500	20031027	940	
50049850	MPN500	20040324	1000	0.98
50049850	MPN500	20040324	1000	
50049850	MPN500	20040517	1030	
50049850	MPN500	20040517	1030	
50049850	MPN500	20040712	1010	1
50049850	MPN500	20040712	1010	
50049850	MPN500	20040824	945	0.865
50049850	MPN500	20050330	1000	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	19991014	1140	0.16
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	19991213	1000	0.2
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20000303	1030	0.2
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20000510	1030	0.11
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20000912	1150	0.12
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20001113	1025	0.19
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20001113	1025	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20010307	1110	0.17
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20010307	1110	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20010619	1310	0.22
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20010619	1310	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20011004	1020	0.11
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20011004	1020	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20020402	1115	0.04
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20020402	1115	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20021001	850	0.34
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20021001	850	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20021218	820	0.13
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20021218	820	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20030304	855	0.12
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20030304	855	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20030304	915	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20030304	915	

50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20030610	950	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20030610	950	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20031027	1000	0.08
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20031027	1000	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20040326	910	0.21
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20040326	910	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20040527	900	0.46
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20040527	900	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20040714	930	0.27
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20040714	930	
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20040826	925	0.226
50049920	BAHIA DE SAN JUAN NO. 5 AT SAN JUAN, PR	20050401	930	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020226	930	0.1
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020226	930	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020226	945	0.12
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020226	945	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020529	935	0.02
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020529	935	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020529	945	0.02
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020529	945	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020930	915	0.06
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020930	915	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020930	930	0.06
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20020930	930	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20030303	945	0.02
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20030303	945	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20030303	955	0.02
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20030303	955	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20030611	915	0.03
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20030611	915	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20030611	925	0.03
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20030611	925	

50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20031028	840	0.04
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20031028	840	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20031028	850	0.05
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20031028	850	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040325	830	0.04
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040325	830	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040325	850	0.12
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040325	850	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040526	945	0.03
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040526	945	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040526	1000	0.02
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040526	1000	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040713	1100	0.04
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040713	1100	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040713	1115	0.04
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040713	1115	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040825	955	0.023
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20040825	1010	0.013
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20050331	950	
50049940	BAHIA DE SAN JUAN NO. 3 AT SAN JUAN, PR	20050331	1015	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20020227	815	0.32
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20020227	815	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20020530	840	0.3
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20020530	840	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20021001	830	0.73
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20021001	830	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20030304	745	0.58
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20030304	745	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20030610	900	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20030610	900	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20031027	910	0.34
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20031027	910	

50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040324	925	0.25
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040324	925	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040517	905	1.5
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040517	905	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040517	910	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040517	1030	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040712	910	0.16
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040712	910	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20040824	850	0.566
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20050330	900	
50049960	RIO PUERTO NUEVO AT MOUTH, SAN JUAN, PR	20050330	905	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20020225	1015	0.11
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20020225	1015	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20020528	1015	0.29
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20020528	1015	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20021007	750	0.08
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20021007	750	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20030307	1020	0.25
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20030307	1020	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20030307	1025	0.22
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20030617	930	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20030617	930	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20031104	810	0.15
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20031104	810	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20040402	815	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20040402	815	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20040518	1200	0.05
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20040518	1200	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20040721	940	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20040721	940	
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20040827	940	0.169
50050105	QDA SAN ANTON NR URB. COUNTRY CLUB, CAROLINA PR	20050407	930	

50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20020225	830	0.13
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20020225	830	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20020528	845	0.44
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20020528	845	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20021007	855	0.14
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20021007	855	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20030307	825	0.13
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20030307	825	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20030617	830	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20030617	830	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20031031	815	0.28
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20031031	815	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20040401	845	0.22
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20040401	845	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20040519	1010	0.16
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20040519	1010	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20040716	830	0.138
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20040716	830	
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20040902	925	0.274
50050310	QUEBRADA BLASINA AT SABANA GARDENS, SAN JUAN, PR	20050406	1020	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20020301	850	0.11
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20020301	850	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20020301	900	0.08
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20020301	900	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20020603	1000	0.06
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20020603	1000	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20021003	810	0.1
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20021003	810	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20030306	910	0.07
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20030306	910	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20030616	910	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20030616	910	

50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20031031	850	0.08
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20031031	850	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040401	930	0.06
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040401	930	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040401	945	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040401	945	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040519	1115	0.09
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040519	1115	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040716	930	0.036
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040716	930	
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20040902	1000	0.049
50050340	LAGUNA PINONES NO. 2 NR CAROLINA, PR	20050406	1110	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20020228	905	0.14
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20020228	905	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20020228	915	0.12
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20020228	915	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20020531	1015	0.31
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20020531	1015	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20020531	1030	0.13
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20020531	1030	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20021003	1015	0.18
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20021003	1015	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20021003	1025	0.11
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20021003	1025	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20030306	1110	0.22
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20030306	1110	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20030306	1120	0.15
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20030306	1120	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20030616	1055	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20030616	1055	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20030616	1100	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20030616	1100	

50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20031103	945	0.3
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20031103	945	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20031103	955	0.51
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20031103	955	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040330	935	0.2
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040330	935	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040330	945	0.19
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040330	945	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040330	1000	0.33
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040330	1000	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040330	1010	0.35
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040330	1010	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040528	745	0.16
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040528	745	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040528	800	0.18
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040528	800	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040720	915	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040720	915	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040720	930	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040720	930	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040831	835	0.14
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20040831	850	0.073
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20050406	1200	
50050353	SUAREZ CANAL AT HWY 26 BRIDGE NR CAROLINA, PR	20050406	1215	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20020228	935	0.11
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20020228	935	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20020228	945	0.12
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20020228	945	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20020531	1115	0.18
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20020531	1115	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20020531	1130	0.05
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20020531	1130	

50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20021003	940	0.13
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20021003	940	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20021003	950	0.08
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20021003	950	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20030306	1035	0.18
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20030306	1035	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20030306	1045	0.07
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20030306	1045	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20030616	1025	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20030616	1025	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20030616	1030	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20030616	1030	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20031103	910	0.41
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20031103	910	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20031103	920	0.17
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20031103	920	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040331	1015	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040331	1015	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040331	1030	0.09
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040331	1030	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040525	1100	0.18
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040525	1100	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040525	1135	0.12
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040525	1135	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040719	1000	0.041
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040719	1000	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040719	1015	0.017
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040719	1015	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040901	1040	0.032
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20040901	1050	0.035
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20050405	1035	
50050355	LAGUNA TORRECILLA NO. 3 NR CAROLINA, PR	20050405	1050	

50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20020301	955	0.03
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20020301	955	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20020301	1005	0.03
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20020301	1005	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20020603	1100	0.05
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20020603	1100	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20020603	1110	0.07
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20020603	1110	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20021003	905	0.06
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20021003	905	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20021003	915	0.06
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20021003	915	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20030306	1000	0.02
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20030306	1000	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20030306	1010	0.02
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20030306	1010	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20030616	955	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20030616	955	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20030616	1000	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20030616	1000	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20031103	835	0.14
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20031103	835	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20031103	845	0.13
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20031103	845	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040331	900	0.07
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040331	900	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040331	930	0.04
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040331	930	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040525	950	0.1
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040525	950	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040525	1015	0.11
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040525	1015	

50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040719	845	0.011
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040719	845	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040719	900	0.01
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040719	900	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040901	945	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040901	945	0.012
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20040901	1000	0.018
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20050405	935	
50050375	LAGUNA TORRECILLA NO. 1 NR CAROLINA, PR	20050405	954	