Memorandum

MIAMI-DADE COUNTY

Date: February 5, 2008

To: Honorable Chairman Bruno A. Barreiro and Members, Board of County Commissioners

Agenda Item No. 8(R)(1)(A)

From: George M. Burgess
County Manager

Subject: Joint Funding Agreement between the United States Geological Survey and Miami-Dade County in the Amount of $2,769,512 to Develop an Integrated Model of Surface and Groundwater Flow for Evaluating the Effects of Competing Water Demands in Miami-Dade County

RECOMMENDATION

It is recommended that the Board of County Commissioners (Board) adopt the attached resolution approving a Joint Funding Agreement between the Miami-Dade County and the United States Geological Survey (USGS) in the amount of $2,769,512 to develop an "Integrated Model of Surface and Groundwater Flow for Evaluating the Effects of Competing Water Demands" in Miami-Dade County. This agreement provides for a groundwater flow model that will be used jointly between the Miami-Dade Water and Sewer Department (MDWASD) and the Department of Environmental Resource Management (DERM), and represents the County's commitment to optimizing our water resources now and for the future as well as protecting the environment.

SCOPE OF AGENDA ITEM

The impact of this agreement is county-wide, as it will be integral for the initial five-year review of the County's 20-Year Consumptive Use Permit with the South Florida Water Management District (District) as approved on November 15, 2007.

FISCAL IMPACT/FUNDING SOURCE

The fiscal impact to the County is $2,769,512, to be spilt 50-50 between MDWASD and DERM. MDWASD's funding source is departmental revenues and DERM will use proprietary funds. The USGS will fund $440,262, for a total project cost of $3,209,774.

TRACK RECORD/MONITOR

The USGS is a federal agency that is regarded as the national expert in the field of groundwater modeling. MDWASD's Water Resources Section will monitor this agreement.

BACKGROUND

Per the County's 20-Year Consumptive Use Permit, MDWASD is required to submit a detailed review of groundwater modeling information to the District every five years (first review due in November 2012). Groundwater in the Biscayne Aquifer results from the accumulation of rainfall beneath the ground. This groundwater flow model will simulate the volume of groundwater flow in and out of the County's regional canal system, Everglades National Park and Biscayne Bay.

The 20-Year Consumptive Use Permit also revised the allocations of raw water withdrawal from public wellfields. Therefore, MDWASD is required to change the wellfield protection areas to be consistent with the permit. This groundwater flow model will enable MDWASD to simulate the ground water levels

after raw water is withdrawn from public wellfields. The County needs a groundwater flow model capable of simulating groundwater flows, surface water flows, canal flows and saltwater intrusion.

At the present time, no such model exists. This USGS proposal will develop a comprehensive groundwater flow model designed to address water resource issues in the County, as well as issues proposed by stakeholders such as the District, the Florida Department of Environmental Protection, Everglades National Park and Biscayne National Park. County personnel will be trained by the USGS to operate the model, thereby allowing County departments to evaluate their own water resource projects saving the County both time and money by eliminating the need to out-source modeling evaluations.

Assistant County Manager

MEMORANDUM

(Revised)

TO: Honorable Chairman Bruno A. Barreiro and Members, Board of County Commissioners

DATE: February 5, 2008

FROM: R. A. Cuevas, Jr. County Attorney

SUBJECT: Agenda Item No. 8(R)(1)(A)

Please note any items checked.

_____ "4-Day Rule" ("3-Day Rule" for committees) applicable if raised

_____ 6 weeks required between first reading and public hearing

_____ 4 weeks notification to municipal officials required prior to public hearing

_____ Decreases revenues or increases expenditures without balancing budget

_____ Budget required

_____ Statement of fiscal impact required

_____ Bid waiver requiring County Manager's written recommendation

_____ Ordinance creating a new board requires detailed County Manager's report for public hearing

_____ Housekeeping item (no policy decision required)

_____ No committee review

Approved _____ Mayor
Veto _____
Override _____

Agenda Item No. 8(K)(1)(D)
02-05-08

RESOLUTION NO. _____

RESOLUTION APPROVING A JOINT FUNDING AGREEMENT BETWEEN MIAMI-DADE COUNTY AND UNITED STATES GEOLOGICAL SURVEY IN THE TOTAL AMOUNT OF $3,209,774, OF WHICH, $2,769,512 WILL BE FUNDED BY MIAMI-DADE COUNTY TO DEVELOP AN INTEGRATED MODEL OF SURFACE AND GROUNDWATER FLOW FOR EVALUATING THE EFFECTS OF COMPETING WATER DEMANDS IN MIAMI-DADE COUNTY, FLORIDA

WHEREAS, this Board desires to accomplish the purposes outlined in the accompanying memorandum, a copy of which is incorporated herein by reference,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that the County Mayor or his designee is hereby authorized, for and on behalf of Miami-Dade County, to execute a Joint Funding Agreement between Miami-Dade County and the United States Geological Survey, in the total amount of $3,209,774, of which, $2,769,512 will be funded by Miami-Dade County, in substantially the form attached hereto, and to exercise the provisions thereof.

The foregoing resolution was offered by Commissioner , who moved its adoption. The motion was seconded by Commissioner and upon being put to a vote, the vote was as follows:

Bruno A. Barreiro, Chairman
Barbara J. Jordan, Vice-Chairwoman

Jose "Pepe" Diaz	Audrey M. Edmonson
Carlos A. Gimenez	Sally A. Heyman
Joe A. Martinez	Dennis C. Moss
Dorrin D. Rolle	Natacha Seijas
Katy Sorenson	Rebeca Sosa
Sen. Javier D. Souto	

The Chairperson thereupon declared the resolution duly passed and adopted this 5th day of February, 2008. This resolution shall become effective ten (10) days after the date of its adoption unless vetoed by the Mayor, and if vetoed, shall become effective only upon an override by this Board.

MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF COUNTY
COMMISSIONERS

HARVEY RUVIN, CLERK

By:_____
Deputy Clerk

Approved by County Attorney as
to form and legal sufficiency:

Henry N. Gillman

ORIGINAL

USGS
2007 DEC -5

Form 9-1366
(Oct. 2005)

U.S. Department of the Interior
U.S. Geological Survey
Joint Funding Agreement

Customer #:	FL016
Agreement #:	08EOFL208017
Project #:	8-2080-
TIN #:	59-6000573
Fixed Cost Agreement	☑ Yes ☐ No

FOR
WATER RESOURCES INVESTIGATION

THIS AGREEMENT is entered into as of the 1st day of March, 2008, by the U.S. GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the MIAMI-DADE COUNTY, party of the second part.

1. The parties hereto agree that subject to availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation AN INTEGRATED MODEL OF SURFACE AND GROUNDWATER FLOW FOR EVALUATING THE EFFECTS OF COMPETING WATER DEMANDS IN MIAMI-DADE COUNTY., herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43 USC 50b.
2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) includes In-Kind Services in the amount of $0.00.

(a) $440,262.00 by the party of the first part during the period March 01, 2008 **to** September 30, 2013

(b) $2,769,512.00 by the party of the second part during the period March 01, 2008 **to** September 30, 2013

(c) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.

(d) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.

3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.
4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.
5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.
6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.
7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

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Form 9-1366 continued	U.S. Department of the Interior U.S. Geological Survey Joint Funding Agreement	Customer #: Agreement #: Project #: TIN #:	FL016 08EOFL208017 8-2080- 59-6000573

8. The maps, records, or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records, or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at costs, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records, or reports published by either party shall contain a statement of the cooperative relations between the parties.
9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered **QUARTERLY**. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

U.S. Geological Survey
United States
Department of the Interior

USGS Point of Contact

Name: Jean Happel
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Ft. Lauderdale, FL 33315
DUNS #: 137784026
Telephone: 954.377.5932
Email: jhappel@usgs.gov

Signatures

By _____ Date 12/04/07
Name: Dr. Barry Rosen
Title: FISC Director

By _____ Date _____
Name:
Title:

By _____ Date _____
Name:
Title:

MIAMI-DADE COUNTY

Customer Point of Contact

Name: Virginia Walsh, P.G.
Address: 3071 S. W. 38th Avenue
Room 554-10
Miami, FL 33146
Telephone: 786.552.8266
Email: WALSHV@miamidade.gov

Signatures

By _____ Date _____
Name:
Title:

By _____ Date _____
Name:
Title:

By _____ Date _____
Name:
Title:

Approved by County Attorney as to form and legal sufficiency:

Henry N. Gillman

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An Integrated Model of Surface and Groundwater Flow for Evaluating the Effects of Competing Water Demands in Miami-Dade County

A Proposal Prepared by the U.S. Geological Survey
November 29, 2007

Problem Statement

The Biscayne aquifer is the major source of potable water in Miami-Dade County, Florida. Overlying the Biscayne aquifer is an extensive network of canals, which is hydraulically connected to the groundwater system. During the wet season, the canals drain the aquifer into the adjacent Biscayne estuary and prevent low lying areas from flooding. Conversely, the canals are used to maintain relatively high aquifer levels in coastal areas during the dry season in order to prevent saltwater intrusion. Although numerical models have been developed for the Biscayne aquifer in Miami-Dade County, these models either lack the ability to represent surface water flow through the canal network or do not contain the resolution necessary to address water resource issues at the county scale. Thus, an adequate tool does not exist for evaluating the effects of water management practices and well-field withdrawals on the surrounding areas.

With an increasing population and the proposed hydrologic changes as part of Everglades Restoration, Miami-Dade County is facing numerous hydrologic challenges. For example, the Miami-Dade Water and Sewer Department (WASD) is tasked with providing 5-year updates on their water use permit issued by the South Florida Water Management District (SFWMD). These permit updates require detailed numerical evaluations on the impact of municipal well fields on surface and groundwater levels. The Miami-Dade Department of Environmental Resources Management (DERM) is also facing hydrologic challenges and must, for example, define well-head protection areas for municipal well fields. In response to these issues, the county is presently seeking a numerical tool that can be used to answer the following questions:

1. How much impact do well-fields have on surface and groundwater flows to Biscayne Bay?
2. What areas recharge the municipal well fields?
3. Do canal management practices or well-field withdrawals increase water losses from Everglades National Park?
4. Could the Biscayne aquifer be better managed by changing well-field operation or canal management practices?
5. Where are the most effective locations to apply reuse water?
6. Will sea-level rise cause saltwater intrusion into coastal well fields?
7. Can well-field operation be optimized to meet hydrologic constraints, such as those mandated for the Northwest Wellfield?
8. What are the impacts of lake excavations on area wide groundwater flows and saltwater intrusion?
9. What are the impacts to the groundwater flow regime if lakes are filled?

Answers to these types of questions require an integrated surface and groundwater model of Miami-Dade County and surrounding areas. To meet the needs of Miami-Dade County, the model must be (1) public domain, (2) capable of being run on a desktop computer, (3) modular and flexible so that other features can be easily incorporated (i.e. lakes, reservoirs, etc.), and (4) must be able to withstand scrutiny from other agencies, such as the SFWMD.

Proposed Solution

To develop a numerical model that can answer these types of questions, the USGS proposes to modify an existing model currently under development by the Fort Lauderdale office. The Fort Lauderdale office is developing a Biscayne aquifer model coupled with a hydrodynamic surface water model of Biscayne Bay and coastal wetlands. This coupled model uses 500-meter cell resolution (Figure 1) and is the successor to a previous SEAWAT model that was used to quantify rates of submarine groundwater discharge to Biscayne Bay (Langevin, 2001, 2003). Presently, the coupled model does not represent flow through the canal network. As part of the proposed project described here, the USGS will develop and add a canal routing feature in order to meet the needs of the county. The model will then be calibrated to a multi-year period to ensure accurate representation of surface and

groundwater flows and the exchange between surface water and groundwater. Following calibration, the model would be used to evaluate several scenarios of interest to the county.

To represent surface water flow through the canal network, the USGS proposes to develop or modify packages to work within the MODFLOW (Harbaugh et al. 2000) and SEAWAT (Langevin et al., 2003) framework. The first package would be canal routing package, such as an enhanced version of the stream flow routing (SFR) package (Prudic et al., 2004), and would calculate canal stage based on specified structure flows. This approach has clear advantages over the more common approach of evaluating water budgets with the more simplistic river package. The second package would be analogous to or a modified version of the SFWMD's Diversion Package, which would calculate structure and pump flows based on stage requirements and other operating rules. This diversions-type package will be used primarily for the scenario evaluations. For the calibration run, the measured structure flows will be specified, instead of calculated by the model. This is the approach used by the District for the "2 by 2" model. Both packages will be developed for general conditions such that the county could use them for other applications.

In addition to the county-wide model, the USGS will also construct local-scale models of the West and Northwest Wellfields to evaluate the effect of high permeability flow zones. Both models will be calibrated to field data. Particle travel time and drawdown maps will also be prepared for both wellfields. Results from this accelerated effort will be used to determine the optimum approach for the county-wide model and will provide insight into future development of wellfield protection maps.

For the results of the model to be useful and accepted by the community, it is critical that stakeholder input be obtained and addressed as part of the development process. This will ensure that model meets its intended purposes and that all relevant data are obtained and incorporated into the model. The USGS will work closely with other agencies, such as the SFWMD and other interested stakeholders, to ensure that the model meets expectations.

Task List

Task 1. Evaluate the effect of high permeability flow zones on wellfield protection areas for the West and Northwest Wellfields.

This task involves the development of local-scale models for the West and Northwest Wellfields and surrounding area. The model will be calibrated with and without the presence of high permeability flow zones, and wellfield protection maps will be prepared for both. This effort will require approximately two years, and will be published as one or more separate USGS reports. Results from this accelerated effort will be used to guide the development of the county-wide modeling effort.

Task 2. Develop a generalized canal flow routing package for MODFLOW and SEAWAT.

This task will be completed by modifying the Stream-Flow Routing (SFR) package to represent canal flow in southern Florida or by developing an entirely new MODFLOW/SEAWAT package. The package may be based on the "level-pool" assumption between structures, and will use a water balance approach to calculate stage fluctuations within the canal. The package will also be programmed to work with MT3DMS (Zheng and Wang, 1999), the solute transport component of SEAWAT, and thus the effects of density and salinity will also be represented within each canal segment.

Task 3. Develop a generalized diversion package that works with the canal flow routing package.

To effectively evaluate alternative water management scenarios, a MODFLOW/SEAWAT package will be developed to route water through the canal system using structures and pumps according to specified operational rules. With this new package, the model will be able to calculate the required water deliveries to the model area in order to meet the operational rules.

Task 4. Develop the input datasets for the integrated model of Miami-Dade County.

Development of an integrated model for Miami-Dade County requires an extensive amount of input data such as rainfall rates, evapotranspiration rates, land surface elevations, aquifer parameters, and so forth. As part of this task, the USGS will compile the required input data and construct the appropriate MODFLOW/SEAWAT packages. For temporally varying input parameters, the USGS is planning to focus on the 1996-2007 time period, although this period may be shortened or lengthened depending on stakeholder input.

Task 5. Calibrate the integrated model for a multi-year period.

If computer runtimes are on the order of hours, the parameter estimation software (i.e. PEST or UCODE) will be used to perform sensitivity analysis and parameter estimation. If computer runtimes are exceedingly long (more than several hours), the model will be calibrated using the traditional trial and error approach. For the calibration run, the new canal flow routing package will be used; however flows at the structures will be specified

instead of simulated with the new diversion package. The USGS will also perform a separate simulation for the calibration period using the new diversion package. Due to discrepancies between operation rules and actual operation, it is expected that this simulation will not match observed values as well as the calibration run with specified structure flows.

Task 6. Perform at least three scenarios with the integrated model.

During the last part of the second year, the USGS will consult with the county to determine which scenarios, in addition to the calibration run (with specified structure flows and flows calculated using the diversion package), will be tested with the model. Results from these three simulations will then be compared with the calibration run using the diversion package.

Task 7. Document and publish methods and results in a USGS report.

In accordance with USGS policy, the methods and results will receive thorough technical review prior to publication in one or more USGS reports.

Task 8. Technology transfer and training

The USGS will provide training to technical staff and interested stakeholders on using the integrated model. Training will be provided during the final year of the project, or sooner, if requested by the county.

Deliverables

Deliverables for this proposed project will be provided to the county upon project completion. These deliverables include:

- One or more USGS reports that document the local-scale models of the West and Northwest Wellfields
- A USGS report that documents the new MODFLOW/SEAWAT canal flow and diversion packages, development and calibration of the integrated Miami-Dade County model, and results from the three scenarios. This report may be divided into one or more USGS reports if warranted.
- All model input datasets, computer code, and auxiliary files will be provided to the county in digital format.

Timeframe

This project is anticipated to start in March 2008, about half way through the 2008 fiscal year. A preliminary and unapproved county-wide model will be available for county use in October of 2011. The timeframe is shown in graphical form below.

Task List	FY08				FY09				FY10				FY11				FY12				FY13			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
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Budget

Costs for the project are shown in the table below. The project is expected to receive funding through the Federal/State Cooperative Program at the dollar amounts indicated in the table. The USGS matching share is contingent upon continued support by the Federal Government of the Federal/State Cooperative Program.

	FY08	FY09	FY10	FY11	FY12	FY13	Total
Miami-Dade County	$268,694	$865,356	$860,244	$313,201	$289,896	$172,121	$2,769,513
USGS	$10,262	$70,000	$100,000	$100,000	$80,000	$80,000	$440,262
Total	$278,956	$935,356	$960,244	$413,201	$369,896	$252,121	$3,209,775

References

Cunningham, K.J., Wacker, M.A., Robinson, E., Dixon, J.F., and Wingard, G.L. 2006. A cyclostratigraphic and borehole-geophysical approach to development of a three-dimensional conceptual hydrogeologic model of the karstic Biscayne Aquifer, Southeastern Florida: U.S. Geological Survey Scientific Investigations Report 2005-5235, 69 p.

Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G., 2000. MODFLOW-2000, the U.S. Geological Survey modular ground-water model -- User guide to modularization concepts and the Ground-Water Flow Process: U.S. Geological Survey Open-File Report 00-92, 121 p.

Langevin, C.D., 2001. Simulation of ground-water discharge to Biscayne Bay, Southeastern Florida: U.S. Geological Survey Water-Resources Investigations Report 00-4251, 127 p.

Langevin, C.D. 2003. Simulation of submarine ground water discharge to a marine estuary: Biscayne Bay, Florida. Ground Water 41, no. 6: 758-771.

Langevin, C.D., Shoemaker, W.B., and Guo, W. 2003. MODFLOW-2000, the U.S. Geological Survey Modular Ground-Water Model—Documentation of the SEAWAT-2000 version with the variable-density flow process (VDF) and the integrated MT3DMS Transport Process (IMT): U.S. Geological Survey Open-File Report 03-426, 43 p.

Prudic, D.E., Konikow, L.F., and Banta, E.R., 2004. A new stream- flow routing (SFR1) package to simulate stream-aquifer interaction with MODFLOW-2000: U.S. Geological Survey Open-File Report 2004-1042, 95 p.

Zheng, C., and Wang, P.P., 1999. MT3DMS, A modular three-dimensional multi-species transport model for simulation of advection, dispersion and chemical reactions of contaminants in groundwater systems; documentation and user's guide, U.S. Army Engineer Research and Development Center Contract Report SERDP-99-1, Vicksburg, MS, 202 p.

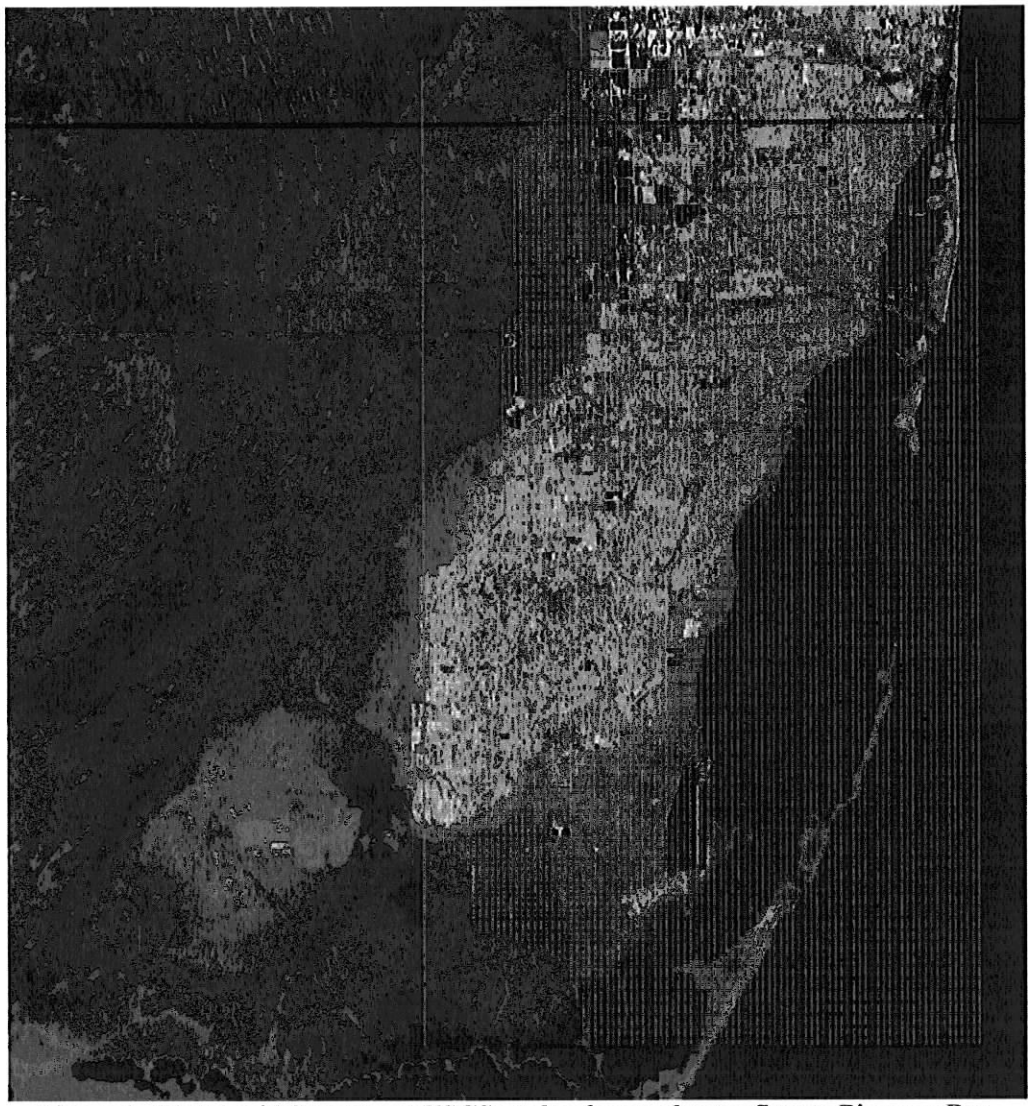

Figure 1. Model grid for present USGS study of groundwater flow to Biscayne Bay.