

**MEETING OF THE WATER RESOURCES COMMITTEE
OF THE BOARD OF DIRECTORS
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA
4040 PARAMOUNT BOULEVARD, LAKEWOOD, CALIFORNIA 90712
12:00 P.M., WEDNESDAY, FEBRUARY 2, 2011**

AGENDA

EACH ITEM ON THE AGENDA, NO MATTER HOW DESCRIBED, SHALL BE DEEMED TO INCLUDE ANY APPROPRIATE MOTION, WHETHER TO ADOPT A MINUTE MOTION, RESOLUTION, PAYMENT OF ANY BILL, APPROVAL OF ANY MATTER OR ACTION, OR ANY OTHER ACTION. ITEMS LISTED AS "FOR INFORMATION" MAY ALSO BE THE SUBJECT OF ANY "ACTION" TAKEN BY THE BOARD OR A COMMITTEE AT THE SAME MEETING.

- 1. DETERMINATION OF A QUORUM**
- 2. PUBLIC COMMENT**
- 3. MINUTES OF THE MEETING OF NOVEMBER 29, 2010**
Staff Recommendation: Approve as submitted.
- 4. GROUNDWATER BASIN UPDATE**
Staff Recommendation: For information.
- 5. GROUNDWATER BASINS MASTER PLAN UPDATE**
Staff Recommendation: For information.
- 6. RECEIVE AND FILE REGIONAL GROUNDWATER MONITORING REPORT-
WATER YEAR 09-10**
Staff Recommendation: Receive and file the water year 09-10 Regional Groundwater Modeling Report.
- 7. USGS CONTRACT AMENDMENT FOR GROUNDWATER MODELING AND
HYDROGEOLOGIC INVESTIGATIONS**
Staff Recommendation: Extend the groundwater modeling contact with the United States Geological Survey, subject to approval of form by District Counsel, for an amount not to exceed \$233,000 and a time extension to December 31, 2011.
- 8. STORMWATER RECHARGE FEASIBILITY STUDY AND PILOT PROJECT DEVELOPMENT**
Staff Recommendation: For discussion.
- 9. GROUNDWATER RELIABILITY IMPROVEMENT PROGRAM (GRIP) UPDATE**
Staff Recommendation: For information.
- 10. FIVE-YEAR CAPITAL IMPROVEMENT PLAN UPDATE**
Staff Recommendation: For information.
- 11. DIRECTORS REPORTS, INQUIRIES, AND FOLLOW-UP OF DIRECTIONS TO STAFF**
- 12. ADJOURNMENT**

Posted by Abigail C. Andom, Deputy Secretary, January 28, 2011

In compliance with the Americans with Disabilities Act (ADA), if special assistance is needed to participate in the Board meeting, please contact Deputy Secretary Abigail Andom at (562) 921-5521 for assistance to enable the District to make reasonable accommodations.

All public records relating to an agenda item on this agenda are available for public inspection at the time the record is distributed to all, or a majority of all, members of the Board. Such records shall be available at the District office located at 4040 Paramount Boulevard, Lakewood, California 90712.

Agendas and minutes are available at the District's website, www.wrd.org.

UNAPPROVED
MINUTES

UNAPPROVED
MINUTES

**MINUTES OF NOVEMBER 29, 2010
SPECIAL MEETING OF THE WATER RESOURCES COMMITTEE
OF THE BOARD OF DIRECTORS
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA**

A special meeting of the Water Resources Committee of the Water Replenishment District of Southern California was held on Wednesday, November 29, 2010, 12:29p.m. at the District Office, 4040 Paramount Boulevard, Lakewood, California. Director Rob Katherman called the meeting to order and presided thereafter. Deputy Secretary Abigail C. Andom recorded the minutes.

1. DETERMINATION OF A QUORUM

Attendees at the meeting were as follows:

Committee: Directors Albert Robles and Rob Katherman

Staff: Robb Whitaker, Ted Johnson, Jason Weeks, Jim McDavid,
Charlene King

2. PUBLIC COMMENT

None.

3. MINUTES OF THE MEETING OF AUGUST 4, 2010

The minutes were approved as submitted.

4. GROUNDWATER BASINS MASTER PLAN UPDATE

Senior Engineer Jason Weeks provided an update on the development of the Groundwater Basins Master Plan. Mr. Weeks stated staff and consultants are working on the development and evaluation of the conceptual alternative management scenarios for the West Coast Basin portion of the Plan. He stated that good feedback was provided by the pumpers and the findings will be summarized into a Technical Memorandum. On the Central Basin portion of the study, he stated that interviews with Central Basin water rights holders have been initiated and are currently on-going. Mr. Weeks stated that the two portions of the Plan should be in sync by early 2011 and the Plan completed by September 2011.

5. AWARD OF CONTRACT FOR GROUNDWATER MODELING SERVICES RELATED TO RECYCLED WATER PERMIT COMPLIANCE AT THE ALAMITOS AND DOMINGUEZ GAP SEAWATER BARRIERS

Chief Hydrogeologist Ted Johnson stated that for the past few years, the District has had separate annual contracts with consulting firms to perform groundwater modeling services related to the recycled water permits at the Alamitos and Dominguez Gap Seawater Barriers. Mr. Johnson noted that permits for these projects were required by the L.A. Regional Water Quality Control Board. He stated that a major upgrade to the Alamitos Barrier model was recently completed in cooperation with the L.A. County Department of Public Works and the Orange County Water District to

make the model more uniform and accessible. Mr. Johnson explained that due to the update and because results are required from both Alamitos and Dominguez Gap Barrier models within a month of each other, staff is recommending contracting the annual modeling of the Alamitos and Dominguez Gap barriers to the same consulting firm. He added that for efficiency and cost reduction, staff is also recommending that the term of the contract be for three years instead of one year.

Mr. Johnson stated that the Board authorized staff to release a request for proposals (RFP) for the modeling work and a total of 11 proposals were received by the District. A proposal review panel evaluated the submissions and based on qualifications and overall value, the panel recommended award of contract to Intera. He noted that Intera recently completed the updated model for the Alamitos Seawater Barrier and did an excellent job, staying on budget and schedule. Mr. Johnson added that the Intera team knows the Alamitos Model better than any other team and can quickly come up to speed on the Dominguez Gap model as they demonstrated in their proposal.

Mr. Johnson stated that the cost of the three-year contract is a not to exceed amount of \$166,000, with the first report expected to be completed by February 2011.

Discussion followed and the Committee recommended the Board enter into an agreement with Intera, subject to approval of form by District Counsel, for groundwater modeling services related to recycled water permit compliance at the Alamitos and Dominguez Gap seawater barriers for a cost not to exceed \$166,000.

6. TIME EXTENSION FOR PROFESSIONAL SERVICES AGREEMENT WITH WORLEY PARSONS FOR ASSISTANCE WITH CONTAMINATED SITE INVESTIGATION AND EXPEDITED CLEANUP

The Committee recommended the Board extend the termination date of the professional services agreement with WorleyParsons to June 30, 2011, with no additional cost to the District.

7. CONTRACT AMENDMENT FOR GEOTRANS FOR WELL PROFILING SERVICES

Associate Engineer Charlene King stated that one of the programs WRD utilizes to properly manage the groundwater resources is the Well Profiling Program. Ms. King explained that the program is used to test water supply wells located in the District's service area to determine the flow and water quality profiles entering the wells from different zones across the perforated intervals. She noted that the current testing methods of the program include dynamic flow profiling and zone sampling. She stated that by testing and sampling different sections of a well and possibly sealing off zones with contamination, the well can produce water that will not require treatment before entering the distribution system. She

noted that the contaminated zones can be targeted for future remediation to avoid pumping out of the cleaner aquifers.

Ms. King stated that the District entered into an agreement with GeoTrans Inc. for well profiling and testing services for five wells currently participating in the program. She noted that delays have been encountered because the owners had to take the well out of service and perform repairs. Ms. King stated that staff is recommending a time extension with GeoTrans and an addition of another well which has been budgeted for fiscal year 2010-11.

Discussion followed and the Committee recommended the Board amend the existing agreement with GeoTrans Inc., subject to approval of form by District Counsel, to extend the term to June 30, 2011 and to increase the contract amount by \$30,000.

Director Katherman recommended that staff look into expanding the program during the mid-year budget review with the addition of three new wells and work at negotiating a better price. He asked that the item be referred to the Finance Committee during the budget process.

8. CONTRACT AMENDMENT FOR DMJ CONSULTING

The Committee recommended the Board amend the existing contract with DMJ Consulting to include a budget increase of \$40,000 for a total contract amount of \$90,000 for on-call hydrogeologic field services.

9. GROUNDWATER RELIABILITY IMPROVEMENT PROGRAM (GRIP) UPDATE

Senior Engineer Jim McDavid provided an update on the Groundwater Reliability Improvement Program (GRIP) project. Mr. McDavid stated that Los Angeles County Sanitation Districts approve the Joint Powers Agreement (JPA) at their meeting held on November 10. He stated that WRD District Counsel has submitted to the Secretary of State the Notice of a Joint Powers Agreement which identifies the framework of the JPA, identifying the mailing address, physical location and purpose of the JPA, and the Notice of Exemption from CEQA.

Mr. McDavid stated that future efforts would include development of a procurement and administrative policy for the JPA, a preliminary engineering and CEQA analysis, and development of a budget for the remaining fiscal year 2010-11 and for 2011-12.

10. CLOSED SESSION

Conference with Legal Counsel – Anticipated litigation, pursuant to Government Code §54956.9(b), One Case

The Committee went into closed session. The Committee reconvened in open session. The Committee reported that there was no reportable action taken.

11. DIRECTORS REPORTS, INQUIRIES, AND FOLLOW-UP OF DIRECTIONS TO STAFF

Director Katherman requested an update on nano-testing at the Vander Lans Facility be provided at next month's meeting.

12. ADJOURNMENT

With no further business for the Committee, the meeting was adjourned at 1:40 p.m.

Chair

ATTEST:

Member



MEMORANDUM

ITEM NO. 4

Prepared by: Ted Johnson

Reviewed by: Nancy Matsumoto

Approved by: Robb Whitaker

DATE: FEBRUARY 2, 2011
TO: WATER RESOURCES COMMITTEE
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: GROUNDWATER BASIN UPDATE

SUMMARY

Staff monitors groundwater conditions in the Central and West Coast Basins throughout the year. A summary of current conditions is presented below.

Engineering Survey and Report:

On January 21, 2011, the Board of Directors adopted Resolution No. 11-895 ordering the preparation of the annual Engineering Survey and Report (ESR) and stating the items that are to be included in the report pursuant to Water Code Section 60300, such as the replenishment water needs and water costs of the District for the ensuing water year 11-12. This information, combined with the upcoming budget forecast, provides the Board of Directors with the necessary information to determine the Replenishment Assessment (RA) required for the ensuing fiscal year 11-12.

Staff has drafted the following preliminary schedule (subject to change) to meet the requirements of the Water Code for this year's ESR and RA process:

| Date | Item | Board action |
|-------------|--------------------------|--|
| 01/21/11 | Order preparation of ESR | Adopt Resolution No. 11-895 to order preparation of the ESR |
| 03/18/11 | Receive and File the ESR | Adopt Resolution giving notice that a RA will be established for the ensuing fiscal year 11-12 |
| 04/01/11 | Open Public Hearing | Conduct public hearing on ESR and RA |
| 05/06/11 | Close Public Hearing | Close public hearing on ESR and RA |
| 05/06/11 | Set the RA | Adopt Resolution to set RA for fiscal year 11-12 |

Precipitation:

There was a great start to the rainy season, providing 12.3 inches to date (downtown Los Angeles precipitation station). A normal year is 15.14 inches. But January has been relatively dry and is 33% below normal. This dry spell is consistent with the forecasted La Niña conditions, which call for a wet October - December but dry January - April. At least 3 more inches are needed to reach a normal amount for the year. Otherwise, the winter of 2010-2011 may end up as another dry year for the local region.

Imported Water:

WRD has purchased over 9,600 acre-feet of our 18,000 acre-feet order. Imported spreading was halted in December due to the rains filling the spreading grounds with storm water. But the imported water is anticipated to resume flows in late January or early February as the storm water infiltrates into the aquifers, creating room for the imported water at the spreading grounds. After the 18,000 acre-feet are delivered, WRD will be exploring a purchase of another 6,500 acre-feet to meet our budgeted amount of 24,500 acre-feet for the current fiscal year.

Pumping:

The numbers for the water year ending September 30, 2010 have been finalized. Last year's pumping of 241,105 acre-feet was very close to the anticipated amount of 240,200 acre-feet. The difference was only 905 acre-feet, or a less than one percent. The current year estimate of 243,000 acre-feet was made back in May 2010 based on increased pumping patterns being observed and discussion with pumpers. However, the actual amount in the current year will depend based on water demand and actual pumping operations that materialize.

Groundwater Levels:

Every winter groundwater levels rise in the Montebello Forebay due to reduced pumping demands and storm water recharge. Water levels are expected to rise until the normal decline begins in April as the storm season ends and pumping increases. Currently water levels in key well 1601T are rising at a rate of 1.5 to 2 feet per week. The rains we receive in February through April will affect how high the water levels rise. Staff will report to the committee in May how the winter rains affected water levels in the Montebello Forebay. In the West Coast Basin, water levels are remaining relatively unchanged, as the confined aquifers there do not respond as quickly to rainfall events as do the unconfined aquifers in the Montebello Forebay.

Detailed information on the groundwater conditions and replenishment water needs will be presented in the Engineering Survey and Report.

FISCAL IMPACT

For information.

STAFF RECOMMENDATION

For information.



MEMORANDUM

ITEM NO. 5

Prepared by: Jason Weeks

Reviewed by: Ted Johnson

Approved by: Robb Whitaker

DATE: FEBRUARY 2, 2011

TO: WATER RESOURCES COMMITTEE

FROM: ROBB WHITAKER, GENERAL MANAGER

SUBJECT: GROUNDWATER BASINS MASTER PLAN UPDATE

SUMMARY

District staff and its consultants, CH2MHILL and RMC Water and Environment, are continuing work on the development of a Groundwater Basins Master Plan for the West Coast and Central Basins (Plan).

Phase 1 of the Plan consists of review and refinement of goals and objectives based on input from water rights holders and basin stakeholders, interviews with water rights holders and basin stakeholders to develop projected baseline conditions for future operations of the basins, and the development of conceptual alternative management scenarios for future basin operations to reduce reliance on imported water.

District staff and consultants have completed interviews with all major water rights holders in the West Coast Basin that serve residential customers and all major industrial water rights holders, which consist of refineries. The development and groundwater modeling of conceptual alternative management scenarios in the West Coast Basin is currently underway.

Interviews with Central Basin water rights holders have been initiated and are currently ongoing. Two workshops were held in November and the third stakeholder workshop was held in early January. A final meeting with Central Basin MWD member agencies (Long Beach, Los Angeles, Compton and CBMWD) is currently being scheduled.

District staff will provide the Committee with an overview of feedback received to date, and an update on the project schedule.

FISCAL IMPACT

None.

STAFF RECOMMENDATION

For information.



MEMORANDUM

ITEM NO. 6

| | |
|---------------------|---------------|
| <i>Prepared by:</i> | Tony Kirk |
| <i>Reviewed by:</i> | Ted Johnson |
| <i>Approved by:</i> | Robb Whitaker |

DATE: FEBRUARY 2, 2011

TO: WATER RESOURCES COMMITTEE

FROM: ROBB WHITAKER, GENERAL MANAGER

SUBJECT: RECEIVE AND FILE REGIONAL GROUNDWATER MONITORING REPORT – WATER YEAR 09-10

SUMMARY

WRD Staff is pleased to submit our groundwater monitoring report for water year 09-10. WRD has been monitoring the Central and West Coast Groundwater Basins (CWCB) for over 50 years, and this year's annual report presents the most comprehensive information to date due to our growing network of aquifer-specific monitoring wells and in-depth water quality analysis. The report, which is in the final stages of preparation, describes the groundwater levels, groundwater quality and replenishment water quality for the CWCB for the previous water year. The purpose of the Regional Groundwater Monitoring Program is to perform the basic District function of tracking groundwater levels and groundwater quality. This information is utilized to determine the health of the groundwater basins and to assist in development of concepts to optimize the use of our local groundwater resource. The major components of the staff-implemented program include the following:

- Establish and maintain a network of specialized monitoring wells throughout the District.
- Collect water levels from these wells at regular (daily) intervals using automated data loggers.
- Collect water quality samples from these wells twice per year using the Districts' hydrogeology field staff and sampling vehicles.
- Collect water quality data for the different types of replenishment waters recharging the CWCB.
- Perform in-depth analysis of the water level and water quality data to establish first hand knowledge of current basin conditions. Construct tables, maps and charts to present the results of the data and identify trends.
- Incorporate the information into WRD's Geographic Information System (GIS) for efficient database storage and retrieval for use by Staff, Stakeholders, and the public.
- Prepare Annual Reports on the Program findings which are made available on our web page and mailed to basin pumpers and other stakeholders.

Staff will provide an overview of the results of the program for water year 09-10 at the Committee meeting.

FISCAL IMPACT

None at this time.

STAFF RECOMMENDATION

Receive and file the water year 09-10 Regional Groundwater Monitoring Report.



MEMORANDUM

ITEM NO. 7

Prepared by: Ted Johnson

Reviewed by: Nancy Matsumoto

Approved by: Robb Whitaker

DATE: FEBRUARY 2, 2011

TO: WATER RESOURCES COMMITTEE

FROM: ROBB WHITAKER, GENERAL MANAGER

SUBJECT: USGS CONTRACT AMENDMENT FOR GROUNDWATER MODELING AND HYDROGEOLOGIC INVESTIGATIONS

The U.S. Geological Survey (USGS) continues to progress under their contract with WRD to perform major upgrades to their 1971-2000 groundwater computer simulation model of the Central and West Coast basins. They also continue to provide cost-sharing cash and in-kind contributions to help offset the fiscal impact to WRD.

The modeling upgrades are being performed based on the new information gleaned from the additional aquifer-specific WRD monitoring wells installed since 2000 and the extensive groundwater monitoring that the District has performed since then to identify trends in groundwater levels. The upgrades will also include refining the model's resolution to 1/8-mile square cells versus the previous model's 1/2 - mile cells, and creating 11 vertical layers to simulate groundwater flow in the various aquifers versus the previous model's 4 layers. Time frames for model calculation will improve from annual measurements to quarterly. All of these upgrades will lead to a much improved groundwater modeling simulator for the District's future management efforts.

Such a major upgrade is a multi-year process of step-wise procedures and analysis. Work completed in 2010 towards this effort was a major re-analysis of the structural geology of the basins using a process known as sequence stratigraphy, which will form the basis for the new model layers. A lithostratigraphic model was also completed to determine grain sizes and soil types to use as physical property inputs into the new model. The basic framework of the model was also completed. For 2011 it is anticipated that the work will culminate with the completion of the transient-calibrated working model of the Central and West Coast Basins by the end of September 2011, with a final report being drafted by the end of the calendar year.

Attached to this Staff Report is a detailed description by the USGS on the work completed in 2010 and the proposed work for 2011.

FISCAL IMPACT

The total cost for the 2011 modeling work is \$464,000 of which WRD is requested to provide \$233,000 (50%) and the USGS will provide \$231,000 (50%). This was an anticipated item and is budgeted in the current fiscal year under Project 025 (Hydrogeology Program).

STAFF RECOMMENDATION

Extend the groundwater modeling contract with the United States Geological Survey, subject to approval of form by District Counsel, for an amount not to exceed \$233,000 and a time extension to December 31, 2011.



United States Department of the Interior

U.S. GEOLOGICAL SURVEY
California Water Science Center
San Diego Projects Office
4165 Spruance Road, Suite 200
San Diego, California 92101-0812
Office: (619) 225-6106 Fax: (619) 225-6101
<http://water.wr.usgs.gov>

January 28, 2011

Mr. Ted Johnson
Chief Hydrogeologist
Water Replenishment District
4040 Paramount Blvd.
Lakewood, CA 90712

Subject: Update on cooperative hydrogeology project, January 1, 2010, through September 30, 2011

Dear Ted,

The following letter summarizes work completed by the U.S. Geological Survey (USGS) as part of our cooperative program from January 1, 2010 to today as well as proposed work and budget to continue groundwater modeling to September, 30, 2011. Detailed descriptions are included in appendices: I (Background), II (Completed work), III (Significant findings), IV (Proposed work), V (New Regional Groundwater Flow Model features), and VI (Geochemical interpretation of new data).

Completed work

- Ground-water modeling
 - *Complete a preliminary texture model and a new regional groundwater flow (NRGWF) model*
 - *Evaluated model results and identified issues*
 - *Initiated model revisions to improve model calibration*
- Geochemistry
 - *Collected and analyzed new water-quality data from three monitoring sites.*

Significant Findings

- Ground-water modeling
 - *The NRGWF model integrates several newly-developed sub-models and new software packages, and is able to complete steady state and transient simulations.*
 - *The hydrogeological framework of the NRGWF model is significantly different from the previous USGS regional groundwater flow model (2003).*
 - *A much large set of intensively-monitored, depth-dependent, water-level and water chemistry data are available for the calibration of the NRGWF model.*

- Geochemistry
 - *Ancient recharge from the Montebello Forebay extends to deep and distal portions of the West Coast Basin.*

Proposed work

- Ground-water modeling
 - *Complete framework model revision and improve groundwater flow model calibration*
 - *Prepare documentation on framework and recharge models.*

Proposed budget

Costs and funds for continuing groundwater modeling in fiscal year 2011 (as of September 30, 2011) are outlined in table below:

| Costs (in thousands of dollars) | 10/1/2010 to 1/30/2011 | 2/1/2011 to 9/30/2011 | Total |
|---|------------------------|-----------------------|--------------|
| USGS | 107 | 357 | 464 |
| | | | |
| Funds (in thousands of dollars) | 10/1/2010 to 1/30/2011 | 2/1/2010 to 9/30/2011 | |
| FY2010 Carried-Over | 107 | | 107 |
| USGS | | 124* | 124 |
| WRDSC | | 233 | 233 |
| Total | 107 | 357 | 464 |

* includes \$80,000 federal matching funds and \$44,000 in kind federal salary funds from USGS Geological Division for FFY 2011.

Thank you for your long-standing support of our collective efforts to better understand the groundwater resources of the coastal Los Angeles basin.

Sincerely,

Zhen Li
Hydrologist

Michael Land
Geochemist

Appendix I Background

The USGS and WRDSC entered a 3-year agreement in 2007 to update and upgrade an existing groundwater flow model (Reichard and others, 2003) by utilizing new information on the regional hydrogeology and new capabilities available as part of MODFLOW software. Specific revisions outlined in the original proposal (wrds-usgs-fy07-plan-dec-2006.doc) include:

- Develop stratigraphic maps,
- Revise model layering,
- Reassign pumpage and injection,
- Revise estimates of recharge,
- Modify boundary conditions, and
- Refine model resolutions.

As the work progressed, it was determined that several submodels needed to be constructed. A 3-D sequence-stratigraphic model was built to delineate the structure and layer geometry of coastal sediments, and a 3-D litho-texture model was planned to represent lithologic variation across the model area. For the recharge estimates, a new method was developed to account for the urban irrigation return flow and a distributed watershed model was completed to simulate the daily infiltration from both the precipitation and the irrigation. The main features of the new regional groundwater flow model (NRGWF) are summarized in Appendix V.

Sub-model development provided WRD a set of stand-alone tools for better understanding the hydrogeological framework and for rigorous simulation of the areal recharge. However, sub-model development also required extra time and resources. In January, 2010, the USGS prepared a new four-year scope of work, which included completion of the NRGWF model and other tasks (Proposal _wrds-usgs-study_fy10-13.doc).

Appendix II Work completed, Year 2010

The focus of work during calendar year 2010 has been on the completion of the NRGWF model. As planned in the four-year proposal (Proposal _wrds-c-usgs-study_fy10-13.doc), the following tasks were completed:

- **Task A1: Build a 3-D litho-texture model of the Central and West Coastal Basins**
 - Digitized and re-interpreted lithology into 5 classes with data from 100 well logs
 - Interpolated a 3-D texture distribution within the structure and layering of the sequence stratigraphic model using Rockwork's Lithoblend (e.g. the nearest neighbor) algorithm.
 - Visualized the litho-texture model in EarthVision by importing Rockwork results
- **Task A2: Estimate texture-based hydraulic properties of the NRGWF model layers**
 - Translated 5 litho percentages of the texture model output into MODFLOW layers of hydraulic properties using power mean approach.
 - Mapped and interpolated hydraulic properties of previous groundwater flow model (Reichard and others, 2003) to the NRGWF model space.
- **Task A3: Setup boundary conditions of the NRGWF model**
 - Interpolated hydrograph data from 36 boundary wells to setup preliminary specified head boundaries in Orange County and at the Whittier and Los Angeles Narrows.
 - Assigned density-dependent General Head Boundary (GHB) at offshore areas based on new boundary and layering from the sequence stratigraphic model.
- **Task A4: Calibrate the NRGWF model**
 - Compiled hydrographs of about 300 depth-dependent, multiple-completion wells and 120 long-screen wells for the NRGWF model.
 - Conducted steady state and transient simulations with MODFLOW 2005 using both homogeneous and heterogeneous parameterizations.
- **Task A5: Develop pre- and post- processors for simulation and visualization**
 - Modified layer surfaces of the 3D sequence stratigraphic model for proper layer representation in quasi-3D MODFLOW model.
 - Coded Fortran processors or used existing GIS processors to assemble data and sub-model output for various MODFLOW packages (LPF, CHD, GHB, WEL, MNW, HFB).

- Post- processed watershed model results for distribution of direct and mountain front recharge as a quarterly-averaged flux.
- Animated the spatial and/or temporal variations of translated hydraulic properties, simulated recharge, as well as reported pumping, injection, and spreading for better understanding the complexity and dynamics of the simulated system.
- **Task A8: Apply existing model**
 - This task was not performed.
- **Task C1: Regional geochemical and geological analyses**
 - Collected water-quality samples in conjunction with WRD's spring sampling event at Los Angeles-2(LOS2), City of Bell-1(LABL), and Torrance-1(PM05) monitoring sites.
 - Analyzed 15 samples for major/minor ions, selected trace elements, stable isotopes of water, tritium, and carbon isotopes.
 - Six criteria were established to assist the systematic evaluation of geochemical data from multiple-completions wells. Wells were attributed with descriptors for: major ion composition; trace element ratios; redox category/process; stable isotope signature; groundwater residence time; probable source of recharge.
 - Completed a preliminary interpretation of new water-quality and isotopic data (see Appendix VI)

Because the NRGWF model was built to conform to the hydrogeological framework rendered in the sequence-stratigraphic and lithology-texture models, and to receive recharge from the distributed watershed model, extra time was spent on the development of customized procedures or codes to bridge the gaps among different models and software. In addition, the NRGWF model assembled massive amount of heterogeneous data, therefore significant effort was put on the compilation and visualization of these data as well as on the understanding the complex hydrogeology and long history of groundwater development contained in the dataset.

In addition to the planned tasks, the USGS also:

- Setup horizontal flow barriers for the NRGWF model using modified faults.
- Re- calibrated the watershed model with updated climate input and irrigation estimates.

- Extended watershed model simulation to include up-gradient drainage basins (San Gabriel watersheds) and incorporate additional stream flow records to enhance watershed model calibration.

The USGS scientists also initiated the following tasks in 2010 (first quarter of FFY2011), in order to resolve local water-level anomalies identified by the WRDSC, to address instability and mass-balance issues of MODFLOW runs, as well as to correct misplacements of selected seismic lines and pumpage inputs based on new information on water levels, sequences, well depths, and model basement. In particular, the USGS is:

- Examining the boundary and layer geometry of the sequence stratigraphic model at selected locations by synthesizing water-level, water quality, pumping and injection data, as well as recharge simulation.
- Revising the sequence stratigraphic model, including reinterpreting seismic data, refining fault geometries, adding new layers, revising layer picks, revising lateral model boundary, and rotating EarthVision grid.
- Improving the litho-texture model by incorporating generalized litho classification from DWR Bull 104 cross-sections.
- Comparing the NRGWF model simulated flow budget with reported values in terms of pumpage, injection, spreading, and recharge, identifying error sources, as well as making corrections.

Publication and communication accomplishments include:

- Reichard, E. G., Z. Li, and C. Hermans (2010), Emergency use of groundwater as a backup supply: Quantifying hydraulic impacts and economic benefits, *Water Resources Research*, 46, W09524, doi:10.1029/2009WR008208.
- Monthly meetings with WRDSC on status and progress of various USGS works
- Continued participation in the WRDSC' water festival and the Central and West Coast Basin Groundwater Contamination Forum.

Significant findings and conclusions from works conducted during Year 2010 are summarized in Appendix III.

Appendix III Significant Findings

Significant findings and conclusions from works during Year 2010 are summarized below:

- ***The NRGWF model integrates several newly-developed sub-models and new software packages, and is able to complete steady state and transient simulation with heterogeneous parameterization and fixed allocation of pumpage and injection.***
 - Simulated total flow budget remains close to the previous model for the same component at the same area. Simulated spatial and temporal variation of each component increased significantly because of the new model resolution and the use of sophisticated sub-models and MODFLOW packages.
 - Simulated water-levels across the basins are still high compared to the observed. The NRGWF model fails on convergence using hydraulic properties from power-mean translation of the new litho-texture model and/or with dynamic allocation of pumpage and injection using MNW package. However, the NRGWF model was able to complete runs using mapped hydraulic parameters from the previous model and with fixed allocation of pumpage and injection.
 - Model instability is likely a result of the highly variable fluxes and the highly variable hydraulic properties. Ongoing revision and improvement of the hydrogeological framework, as well as planned use of new solver package are expected to alleviate or resolve the problem.
- ***Comparison of the NRGWF and the previous model (2003) indicates significant difference in structure, layering, as well as faulting. Completely renovate hydrogeological framework demands creation of a new hydraulic parameterization.***
 - The size of new model space is more than 2.5 times of the size of the pervious model; Other than the addition of Orange County area, model expansions are found mainly at the deep portion of the Central Basin.
 - The previous model has 4, relatively thick and flat layers, while the NRGWF model has 11 layers, each varying largely in thickness and geometry. Changes in layering near the Montebello Forebay and at the deep portion of the Central Basin are most prominent.
 - Significant differences are found in both the number and location of the faults as potential horizontal flow barriers.

- To create a hydraulic parameterization that is both geologically plausible and numerically feasible, iterative calibration of both the geological models (sequence and texture models) and the simulation (NRGWF) model is required.
- ***Geochemical analysis of new water quality and isotopic data linked ancient recharge from the Montebello Forebay to deep aquifers at a far west monitoring site (PM-05, zone #1 and #2).***
 - Similar water has been identified elsewhere (Inglewood-2, Compton-2, Long Beach-2, Long Beach-3, Long Beach-4) by previous USGS work, but to date, never this far west.
- ***A unique aspect of the NRGWF model is that it utilizes a much large set of intensively-monitored, depth-dependent, water-level and water chemistry data for calibration.***
 - Most models built by consultants for coastal LA relied on lithostratigraphic-based layering, and model calibrations have been focused on the vertically-averaged, water-level data from long screen wells.
 - Previous USGS model (Reichard and other, 2003) utilized a smaller (number and duration) set of depth-dependent calibration data, and had coarser spatial and temporal resolution (4 layers, ¼-square mile cells, annual stress periods).
 - With detailed, chronostratigraphic-based layering and availability of long-term data from over 300 depth-dependent, multiple-completion wells, the NRGWF model can account for a high degree of complexity and detail.

Appendix IV Plans for Year 2011

The goal of FFY 2011 is to complete the NRGWF model. Proposed tasks for the rest of FFY2011 (2/1/2011 to 9/30/2011) are listed below:

- **Task AA1: Complete revision of the geological framework**
 - Complete work initiated in 2010, including modification of the sequence stratigraphic and litho-texture models. EarthVision faces files of both the structure and lithologic model, along with viewing software, will be provided to WRD.
 - Convert geological model layer and grid for use by the MODFLOW.
- **Task AA2: Improve hydraulic parameterization**
 - Modify translation algorithm by incorporate additional knowledge on hydraulic property value and distribution over the basin.
 - Re-calculate hydraulic properties of the NRGWF model using the modified translation algorithm and revised texture model (Task AA1).
- **Task AA3: Recalibrate the steady state and transient model**
 - Resolve mass-balance issues to ensure that simulated flow budget is consistent with the reported values.
 - Resolve convergence issues associated with model variability and dynamic allocation of pumpage and injection using MNW1 package. These numerical issues are expected to be addressed or alleviated with implementation of the improved hydraulic parameterization (Task AA2).
 - If MNW numerical issues persistent, pumpage and injection will be allocated to each perforated layer based on hydraulic conductivity and length of perforation at each model layer.
 - Calibrate the NRGWF model with possible several iterations of Task AA1-3.
- **Task AA4: Develop pre-and post-processing and visualization tools**
 - Develop additional customized codes or procedures to address different issues or needs in the process of the NRGWF model development.
- **Task AA5: Prepare draft USGS report documenting the NRGWF model**
 - Document the sequence and texture models for the hydrogeological framework of the NRGWF model
 - Document irrigation return flow and watershed recharge modeling for the NRGWF model

Appendix V Features of the NRGWF model

Basic

- 4 coastal basins (West Coast, Central, Santa Monica, and Hollywood)
- 11 layers, 80,000 cells per layer, and cell sized 660 x 660 ft
- Simulation period (1970 to 2007), 145 quarterly stress periods

Hydrogeologic Framework

- A 3D Chronologic sequence stratigraphic model for structure and layering
- A sequence-bounded, Litho-texture model for hydraulic parameterization

Recharge and Discharge

- A watershed-scale, precipitation-runoff model for natural recharge
- Land use and water use analysis for urban irrigation return flows
- Multi-node well package (MNW1) for pumpage and barrier injection

Trans-boundary fluxes

- Density-dependent general head (GHB) for onshore/offshore flow
- Hydrograph-based constant head (CHD) for inter-basin flow at Whittier and Los Angeles Narrows and Orange County **

** may change to GHB or fixed flow condition at late stage of the model calibration.

Appendix VI Preliminary Geochemical Interpretation of New Water Quality and Isotopic Data

Los Angeles-2 (LOS2)

- In general, very little chemical stratification was observed between the Ca-HCO₃/Cl waters observed in zones #2-4. This composition—and elevated chloride concentrations—differs somewhat from the LA-1 and HP-1 sites, and other reported native waters in this portion of the Central Basin.
- TDS is above the SMCL in zones #2-4 (1,130-1,270 mg/L)
- Iron is above the SMCL in zone #3 and #4 (1,160 and 1,670 ug/L)
- Manganese is above the SMCL in zones #2-4 (112-316 ug/L)
- Redox conditions are anoxic, and the reduction of Fe-III is the most likely process occurring throughout zones #2-4.
- Stable isotope ratios for zones #2-4, although slightly more enriched than LA-1 and HP-1, are typical of water recharging through the Los Angeles Forebay. A possible explanation for the slight difference in isotopic signatures could be a greater influx of locally derived, perhaps poorer quality, water.
- On the basis of measurable tritium (zone #3-4), some recent water has infiltrated to a depth of 525ft (Lower Wilmington); residence time for water in zone #2 is more than about 50 years.

City of Bell-1 (LABL)

- The major ion composition, source and movement, and relative age of water at this site is highly stratified with depth, and 3-4 distinct zones.
- TDS is nearly at the SMCL in zone #1 (998 mg/L)
- Boron is above the CA_NL in zone #1 (1,600 ug/L)
- Manganese is above or near the SMCL in zones #2-4 (48- 72 ug/L)

- Zone #1 is distinguished by a tan-colored, mature Na-HCO₃ composition; strongly reducing (possibly methanogenic) conditions; and is tied to recharge originating from the Montebello Forebay more than 10,000 years ago.
- Zones #2-4 appear to be quite similar across three stratigraphic units (Upper Wilmington, Bent Spring, Harbor). All share a source of recharge linked through the Los Angeles Forebay more than about 50 years ago (probably older). The major ion composition grades from Ca/Na-HCO₃ to Ca-HCO₃, with relatively low TDS concentrations, typical of native basin water in this portion of the Central Basin; redox conditions grade from anoxic to suboxic, with the reduction of Mn-IV as the dominant process.
- The Ca-HCO₃ water in zone #5 (Harbor?) is distinguished by slightly higher TDS, modest nitrate concentrations, and absence of iron and manganese (oxic conditions). Coupled with isotopic data, these observations suggest some water in zone #5 is tied to engineered recharge from the Montebello Forebay.
- Zone #6 is distinguished from zone #5 by still higher TDS, a more significant contribution of chloride to the overall composition (Ca-HCO₃/Cl), an enriched isotopic signature, and the absence of measurable tritium. These results compare favorably with water from South Gate-1 #5 and Commerce-1 #6, and collectively point to a local source of recharge (more than about 50 years ago) from the nearby hills.

Torrance-1 (PM05)

- TDS is above the SMCL in zone #1, 2, and 5 (1,030-3,610 mg/L)
- Chloride is above the SMCL in zone #5 (1,560 mg/L)
- Boron is above the CA_NL in zone #1 and #2 (2,470 and 1,940 ug/L)
- Manganese is above the SMCL in zones #1, 5, and 6 (56-321 ug/L)
- Of particular significance at this site is the occurrence of isotopically depleted water (similar to LABL, zone #1) in zone #1(Pliocene. B) and #2. (Lower Wilmington) Previous work has identified this isotopic signature to ancient recharge from the Montebello Forebay and linked it to other deep and distal portions of the basin (Inglewood-2, Compton-2, Long Beach-2, Long Beach-3, Long Beach-4) but, not this far west. These

two zones are further distinguished by a mature Na-HCO₃ composition, strong color (high DOC), and methanogenic conditions.

- Zones #3 and #4 also contain Na-HCO₃ water but, with a lower TDS, slight color, sulfate-reducing conditions, a different isotopic signature. The source of water in zone #4 (Upper Wilmington) is identical to water from PM-04 zone #1 and is tied to recharge originating from the Los Angeles Forebay more than 10,000 years ago. On the basis of stable isotope data, water in zone #3 appears to be a mixture of zone #2 and #4.
- While differences in water quality are apparent between zones #5 and #6, isotopic data help to distinguish these two zones from the other four. An isotopic signature below the MWL (depleted, evaporated) and presence of significant tritium (11-16 TU) suggest some water in these upper zones is linked to recharge from an earlier period of the barrier project



MEMORANDUM

ITEM NO. 8

Prepared by: Ted Johnson
Reviewed by: Robb Whitaker
Approved by: Robb Whitaker

DATE: FEBRUARY 2, 2011

TO: WATER RESOURCES COMMITTEE

FROM: ROBB WHITAKER, GENERAL MANAGER

SUBJECT: STORMWATER RECHARGE FEASIBILITY STUDY AND PILOT PROJECT DEVELOPMENT

For most of WRD's history, approximately 48,000 acre-feet of stormwater were captured and infiltrated each year at the spreading grounds. Relatively recent improvements undertaken by the Los Angeles County Department of Public Works (LADPW) and jointly financed by LADPW and WRD have significantly increased the stormwater portion of WRD's supply portfolio.

- The expansion of the Whittier Narrows Conservation Pool added 3,000 acre-feet to the average annual volume.
- The installation of rubber dams on the San Gabriel River increased the number by another 3,600 acre-feet.
- The Interconnection Pipeline, scheduled for completion next month, will add another 1,300 acre-feet, bringing the total average annual volume to 55,900 acre-feet.

The potential for increasing the use of stormwater for groundwater augmentation is significantly greater. Results of the Water Augmentation Study (an ongoing 10-year research project led by the Los Angeles and San Gabriel Rivers Watershed Council (LASGRWC)) suggest that nearly 180,000 acre-feet per year of stormwater runoff is lost to the ocean from WRD's service area.

Based on a preliminary spatial dataset analysis by using the Groundwater Augmentation Model (GWAM), LASGRWC estimates that within the combined Montebello and Los Angeles Forebays, the passive infiltration of rainfall falling and soaking into the subsurface below the root zone is 9,000 acre-feet annually, whereas 48,000 acre-feet of surface runoff is lost. That analysis suggests that if the developed areas overlying the Forebays captured and infiltrated the first 0.75 inches of runoff, the annual average amount of rainfall that could potentially recharge the Central and West Coast Basins would increase by over 400%, to 41,000 acre-feet. Surface runoff would decrease by over 68% to just 15,000 acre-feet.

The LASGRWC proposes a comprehensive feasibility study to identify regional and parcel-based locations and pilot project concepts and their respective costs and benefits either within the Forebays or District-wide to achieve maximum stormwater capture for water supply benefit. The study will identify with great specificity the best locations for stormwater capture and filtration and the technologies best suited to the locations.

Existing but independent analyses, datasets and modeling tools will be combined to identify where potential pilot projects may be located and to provide concept designs within a focused area.

Existing Spatial Datasets

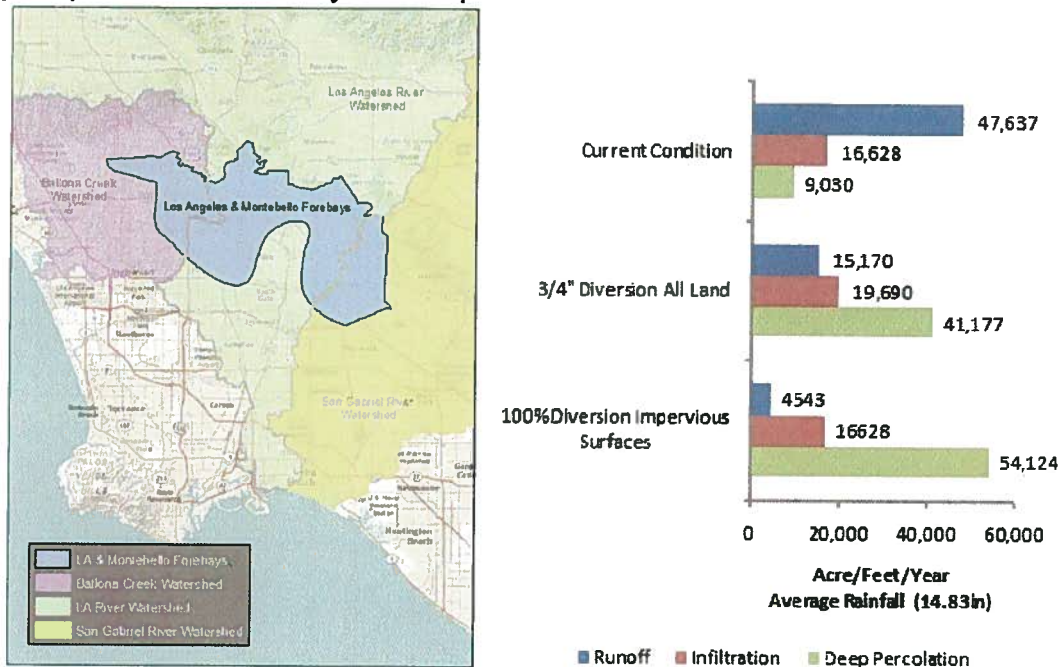
| Dataset | Source | Relevance |
|-----------------------------------|---|--|
| Soils | Los Angeles County | Infiltration potential |
| Soil & Groundwater Contamination | GeoTracker (SWRCB), EnviroStor (DTSC) | Recharge potential |
| Groundwater Basins | Department of Water Resources | Recharge potential |
| Forebay Boundaries | Water Replenishment District (WRD) | Recharge potential |
| Seasonal Groundwater Contours | Water Replenishment District (WRD) | Groundwater conditions |
| Land Use | Southern California Association of Governments (SCAG) | Retrofit potential; surface water quality benefits |
| Parcels | Los Angeles County Assessor | Retrofit potential |
| Precipitation | Los Angeles County; National Climatic Data Center; National Oceanic and Atmospheric Administration (NOAA) | Recharge potential |
| Watershed sub-catchments | Ballona Creek & Los Angeles County SBPAT Geodatabases | Surface water drainage |
| Storm Drain system | Los Angeles County, City of Los Angeles | Surface water drainage |
| Topography | United States Geological Survey (USGS); Los Angeles County | Surface water drainage |
| Surface Water Impairments & TMDLs | Ballona Creek & Los Angeles County SBPAT Geodatabases | Surface water quality benefits |

Modeling Tools

Groundwater Augmentation Model (GWAM)

The Ground Water Augmentation Model (GWAM), developed by the Bureau of Reclamation for the LASGRWC, estimates potential groundwater recharge within the Greater Los Angeles area. GWAM utilizes a GIS interface and soil moisture accounting model to simulate surface

and root zone processes to compute the proportion of precipitation contributing to runoff and to infiltration, which is then sub-divided between the upper soil zone and the vadose zone which is available for aquifer recharge. GWAM can calculate this groundwater recharge potential for the Greater Los Angeles area, for a specific watershed or groundwater basin, or for any user-defined area such as the Los Angeles and Montebello Forebays. An example of preliminary output within the study area is provided 5 below.



Los Angeles and Montebello Forebays Estimated Water Balance (LASGRWC, 2010)

Structural BMP Prioritization and Analysis Tool (SBPAT)

SBPAT is a GIS-based tool developed for the City of Los Angeles, County of Los Angeles Department of Public Works, and Heal the Bay, funded by the RWQCB and SWRCB, as well as the participating agencies and primary contractor, Geosyntec Consultants. The tool identifies areas of priority within a watershed based on water quality loads and impairments and identifies potential solutions; quantifying results and uncertainties as a management and implementation tool. SBPAT was utilized in the draft TMDL Implementation Plans for Ballona Creek and Los Angeles River, and its use was acknowledged and accepted by the RWQCB for compliance with the Clean Water Act. As such many of the area-specific datasets within the Ballona Creek, Los Angeles River, and San Gabriel River watersheds are readily available.



MEMORANDUM

ITEM NO. 9

*Prepared by: Jim McDavid
Reviewed by: Ted Johnson
Approved by: Robb Whitaker*

DATE: FEBRUARY 2, 2011

TO: WATER RESOURCES COMMITTEE

FROM: ROBB WHITAKER, GENERAL MANAGER

**SUBJECT: GROUNDWATER RELIABILITY IMPROVEMENT PROGRAM (GRIP)
UPDATE**

SUMMARY

The GRIP partnership, made up of the Upper San Gabriel Valley Municipal Water District (USGVMWD), Los Angeles County Sanitation Districts (LACSD) and WRD, continues to move forward with developing a program that would replace imported replenishment water with a locally sustainable supply.

As a follow-up to the recent approval of the JPA by the Secretary of State, partnership staff has been working on developing administrative policies for adoption by the JPA Board of Directors. Staff will provide an update of the meeting that is currently scheduled for January 31, 2011, where the election of JPA Board officers and consideration of the draft administrative policies is on the agenda.

FISCAL IMPACT

None at this time.

STAFF RECOMMENDATION

For information.



MEMORANDUM

ITEM NO. 10

*Prepared by: Jim McDavid
Reviewed by: Ted Johnson
Approved by: Robb Whitaker*

DATE: FEBRUARY 2, 2011
TO: WATER RESOURCES COMMITTEE
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: FIVE-YEAR CAPITAL IMPROVEMENT PLAN UPDATE

SUMMARY

In preparation for the upcoming mid-year budget review, and in conjunction with an update of the WRD Strategic Plan, staff has been performing an update of the 5-year capital improvement plan. Staff will outline the basics of this plan and the anticipated capital expenditures during the upcoming 5-year period at the Committee meeting.

FISCAL IMPACT

None at this time.

STAFF RECOMMENDATION

For information.