DRAFT Preliminary Review: Navy Groundwater Flow Model for the Navy Red Hill Facility

By:

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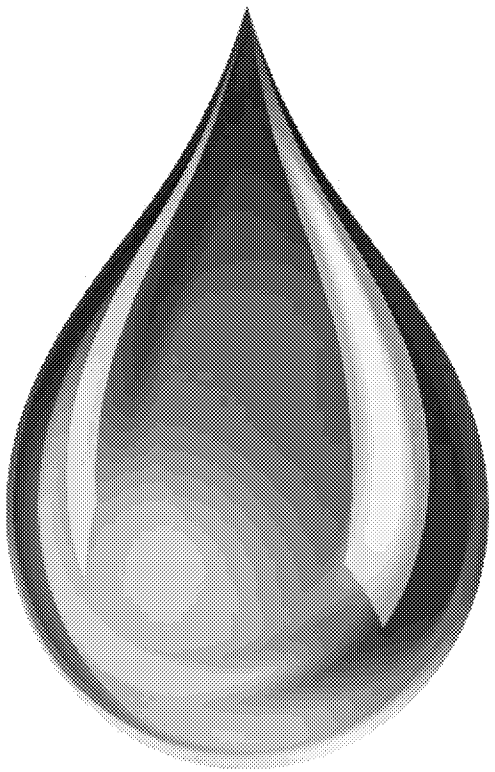
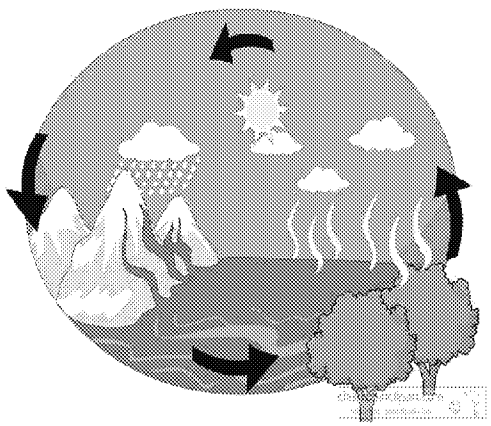
One Overarching Goal



- The purpose of this deliverable is to refine the existing groundwater flow model and improve the understanding of the direction and rate of groundwater flow within the aquifers around the Facility (AOC, 2015)
  - *To do this, the underlying geologic conditions must be refined and better understood in light of new data not available to prior modeling*

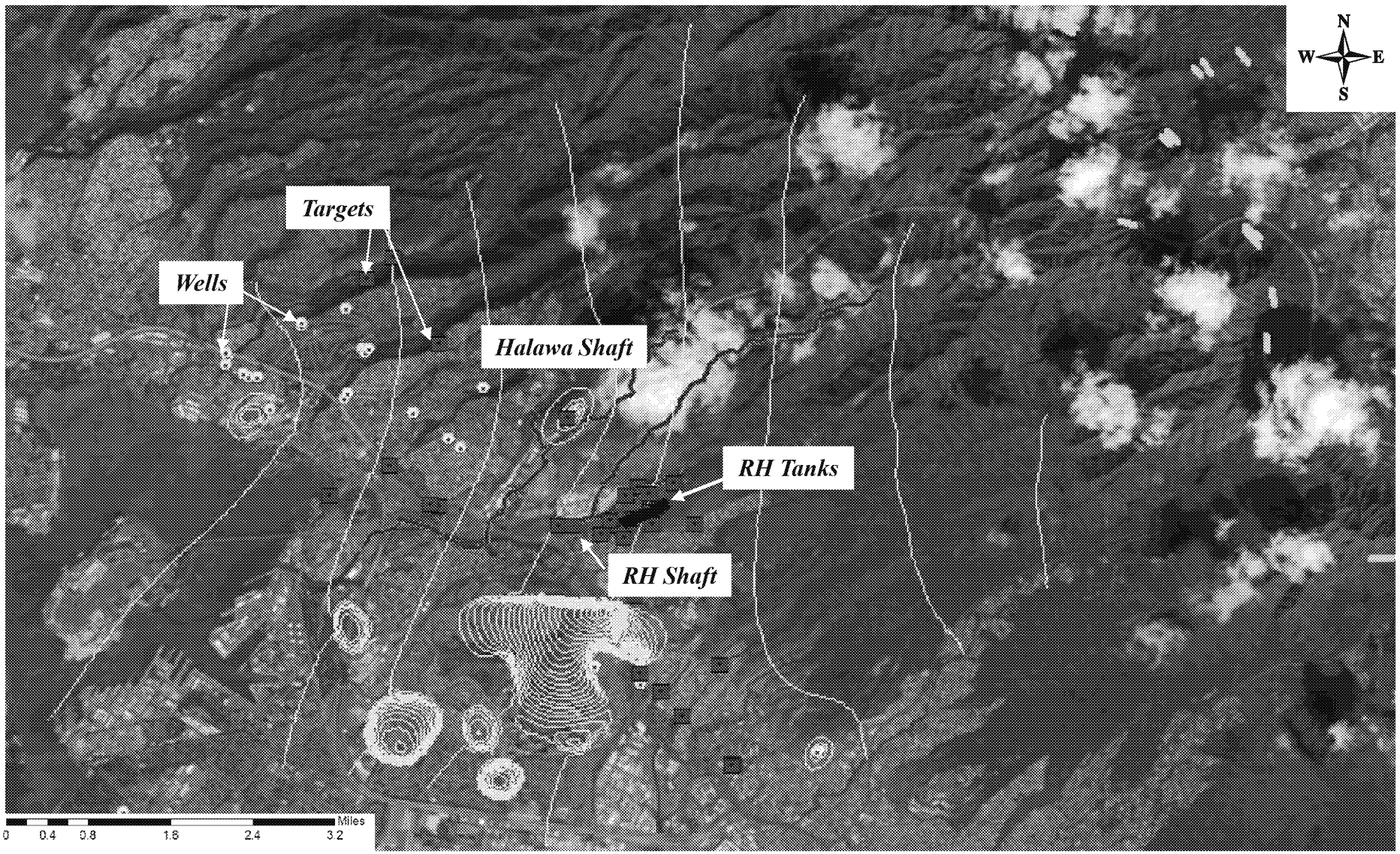
The Navy Has Delivered Multiple Models



- Key review questions:
  - Do the models represent local heads?
  - Do the models represent gradients?
  - Do the models reflect transient aspects?
    - Pumping from Red Hill & Halawa shafts
    - Monitoring well "groupings"
  - Do transient simulations better past models?
  - Are models consistent with geochemistry?
  - Are models consistent with COCs?
  - Are models parameters justified?
- Will the model inform risk estimates?
  - Most uncertain aspect is NAPL
    - Where is it presently & in what state?
    - How far/fast could releases travel?
  - Is there any basis for down-scaling?

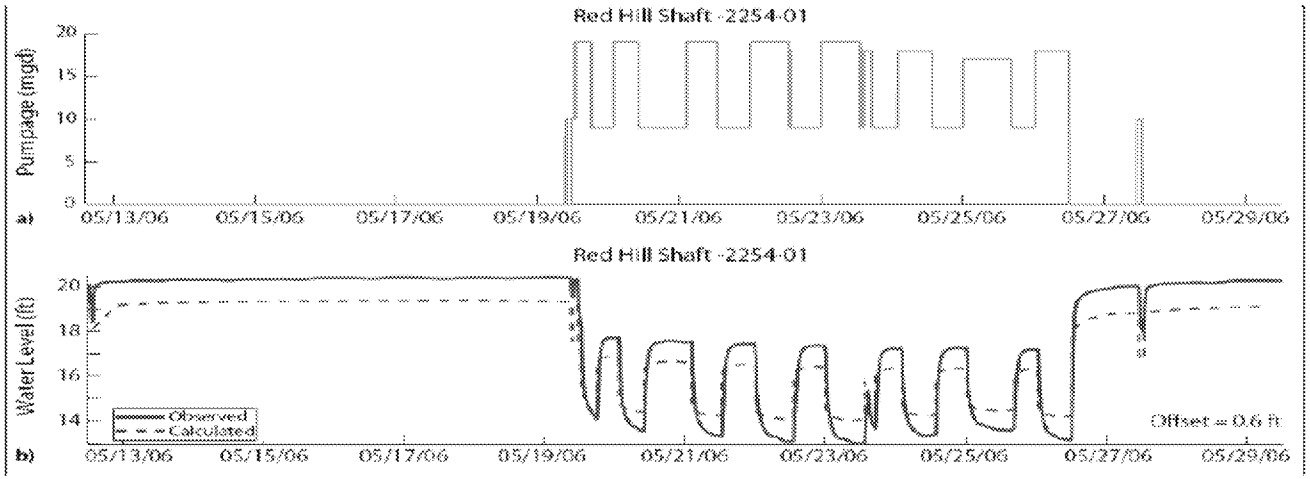
General Area/Model Map

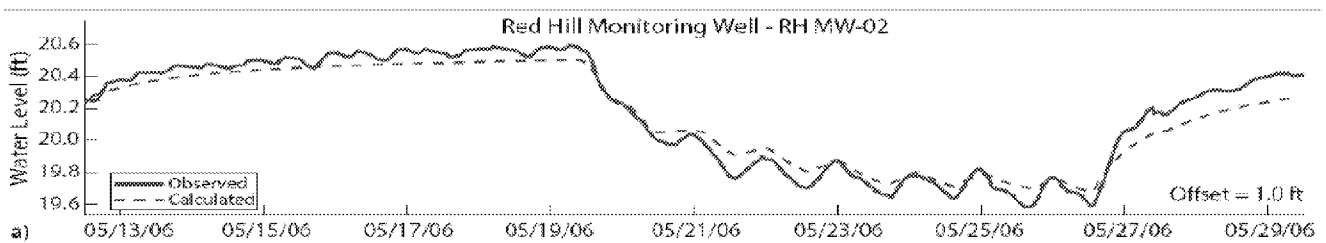
(Halawa Shaft On, RH Shaft Off)

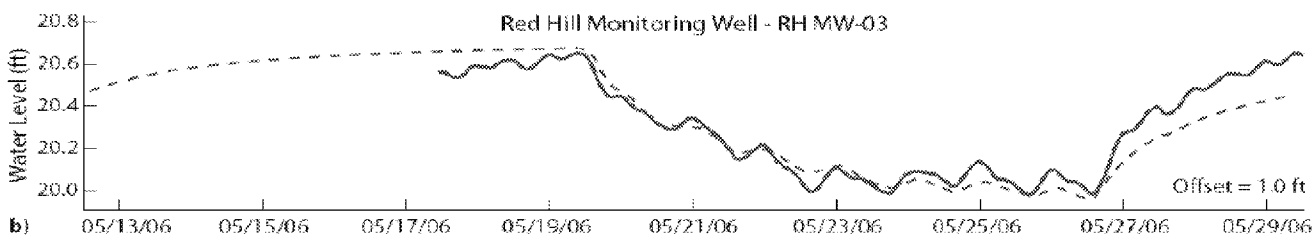


The Primary Issue with Prior Model

(calibrated to drawdown, but not to heads; complexity)

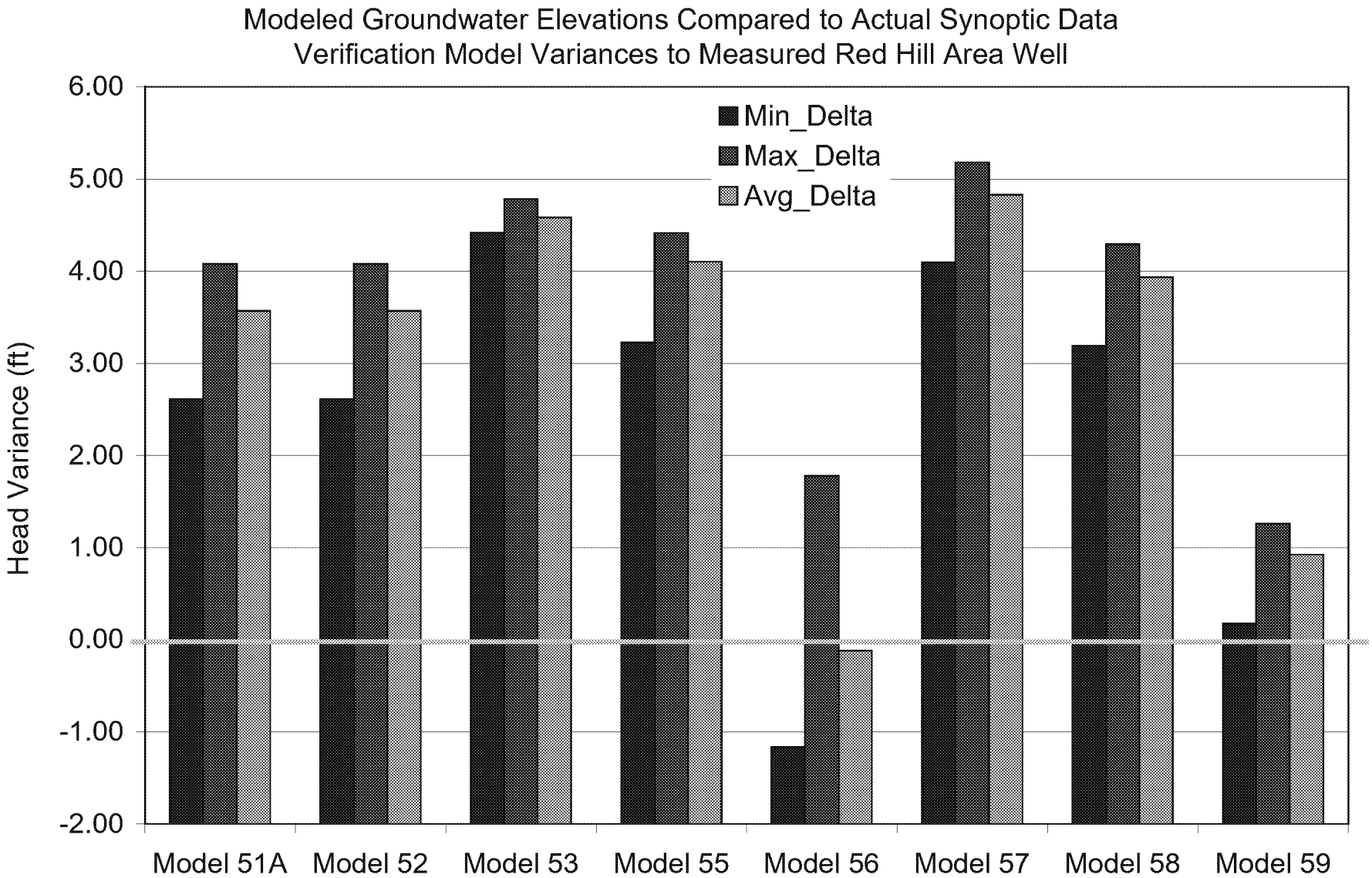




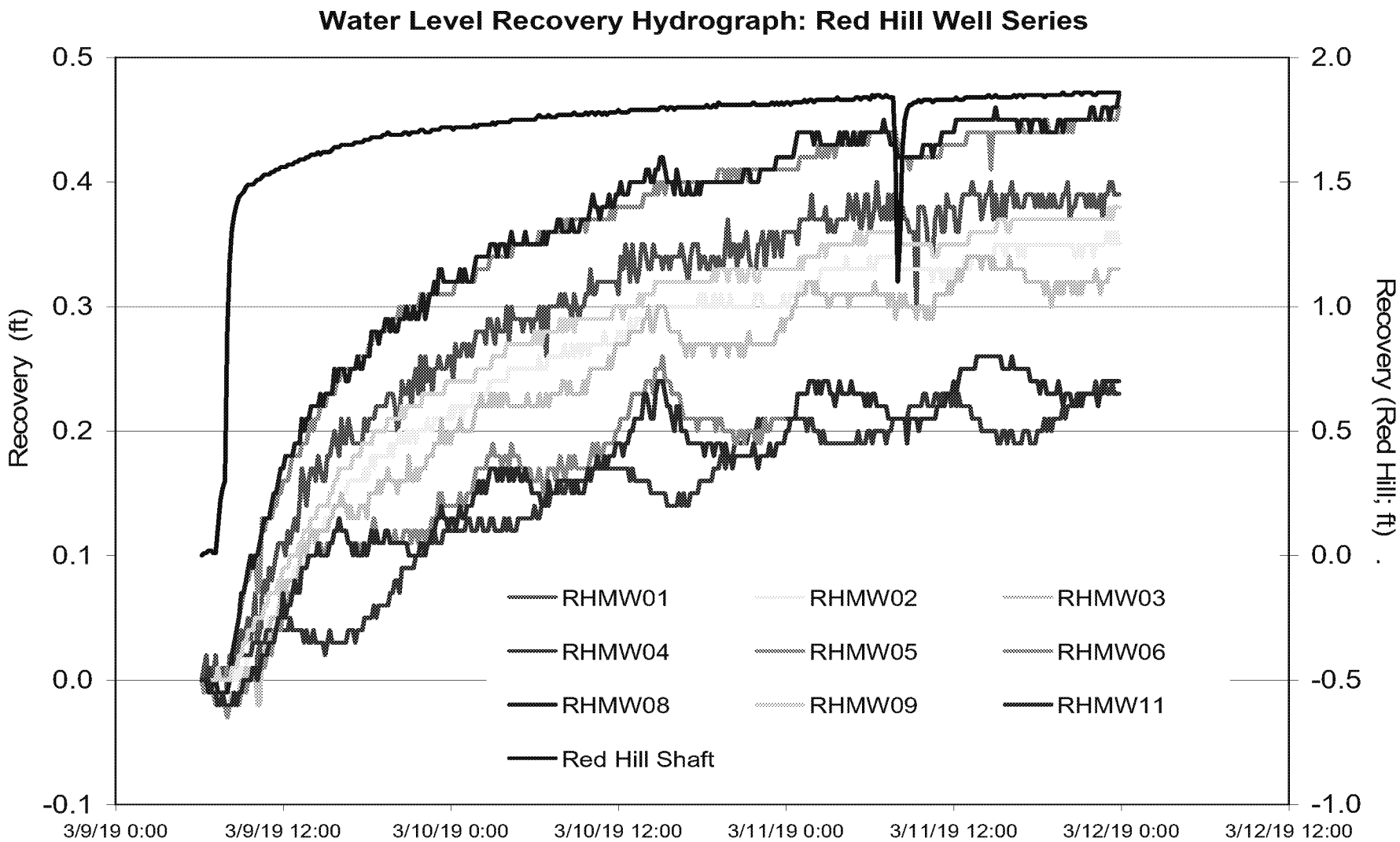


Kolja Rotzoll and Aly I. El-Kadi, 2007

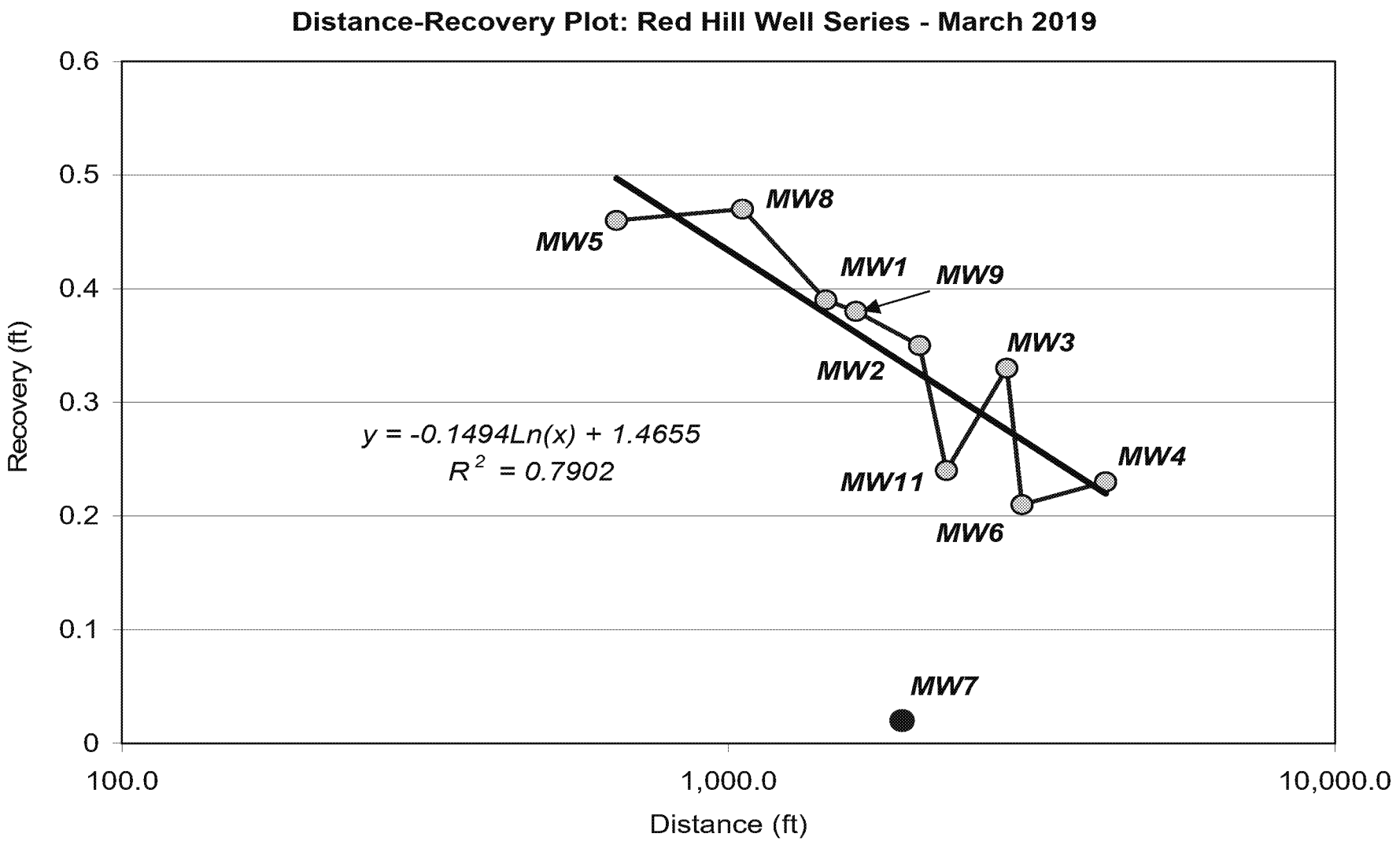
GW Elevation Variance – Transient Models



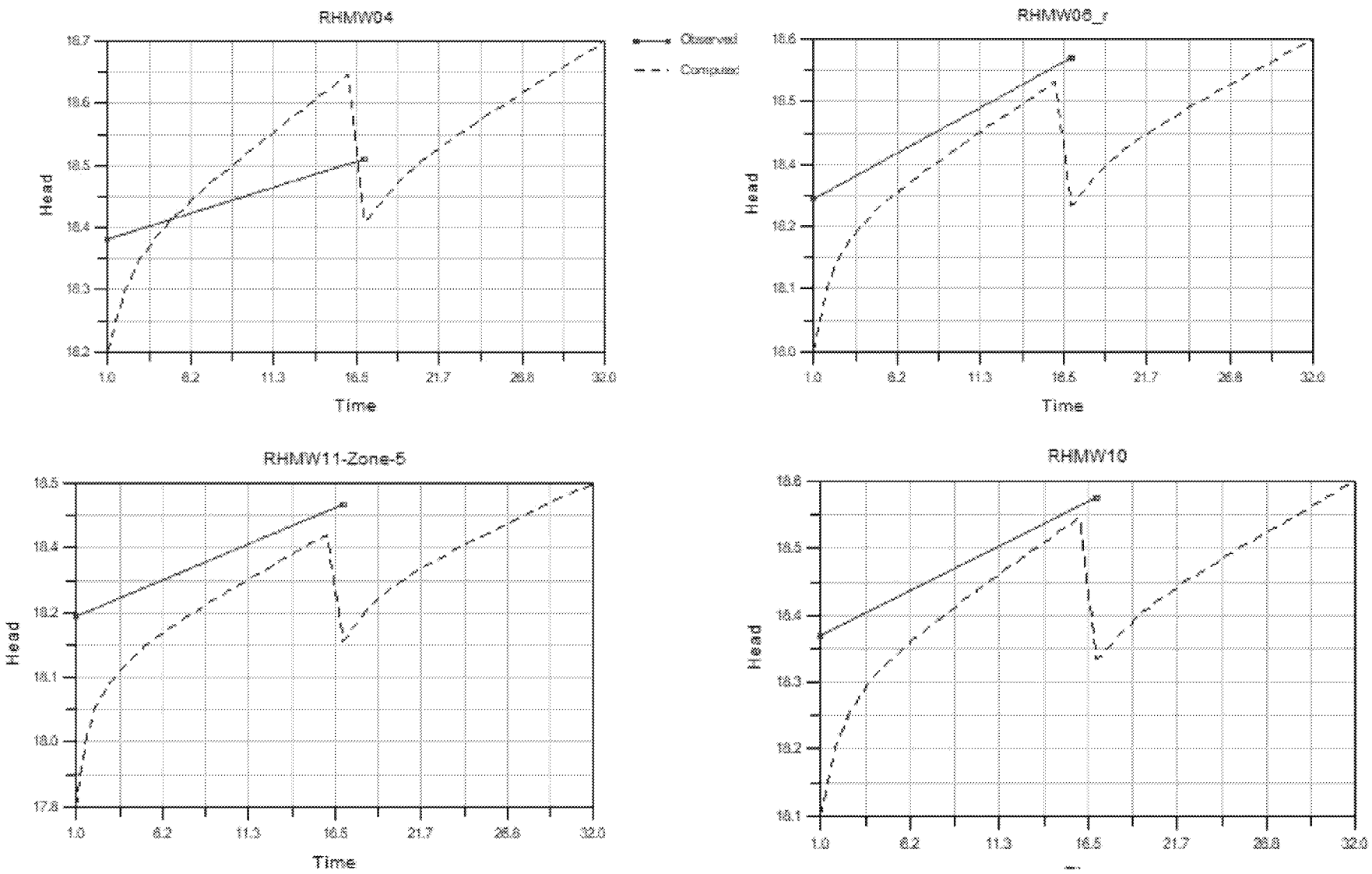
Well Response Differs in Various Wells



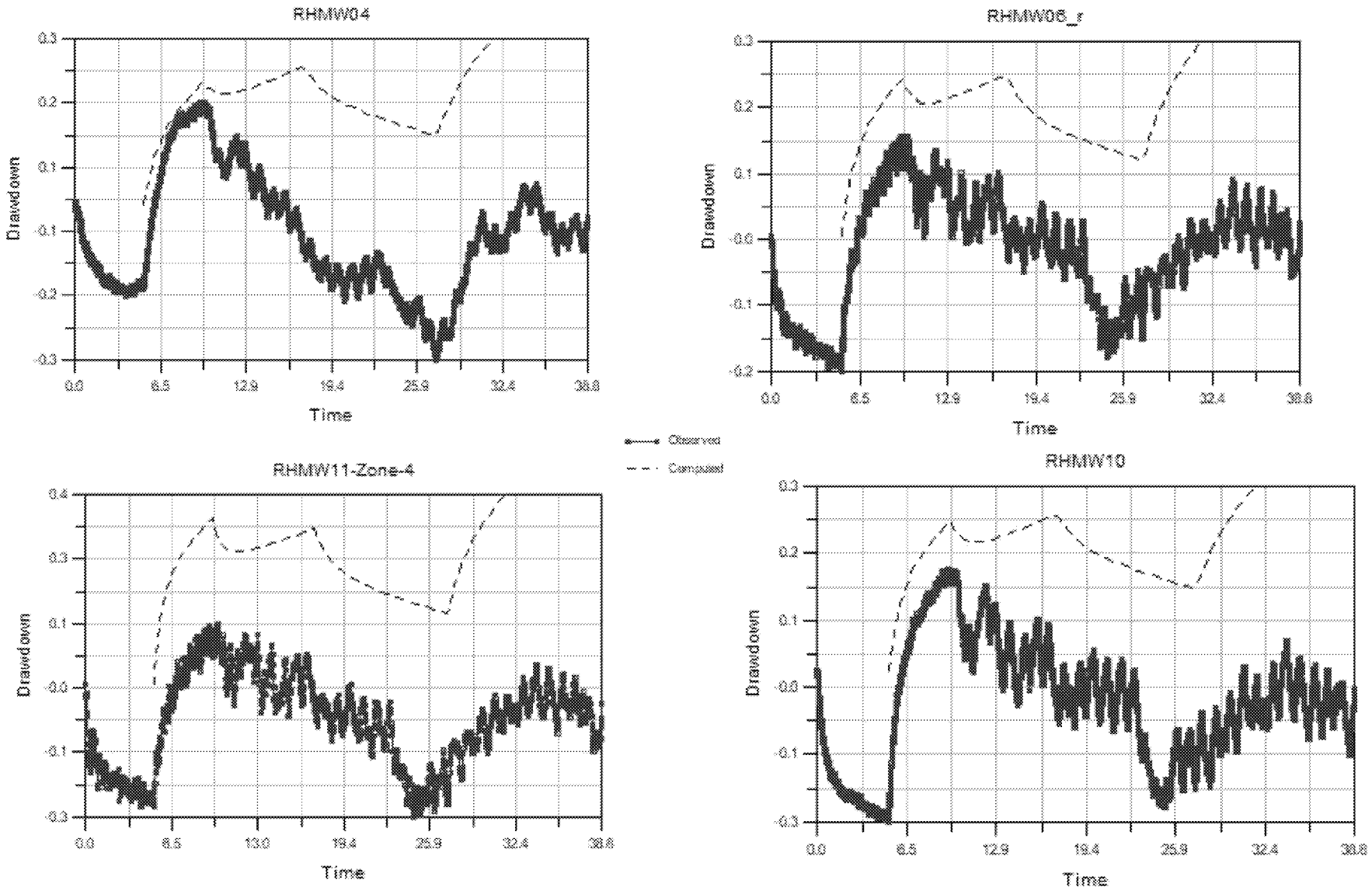
Non-Uniform Distance Drawdown Behavior



Example Hydrographs; M51a Base Case



Example Hydrographs; M51a Verification

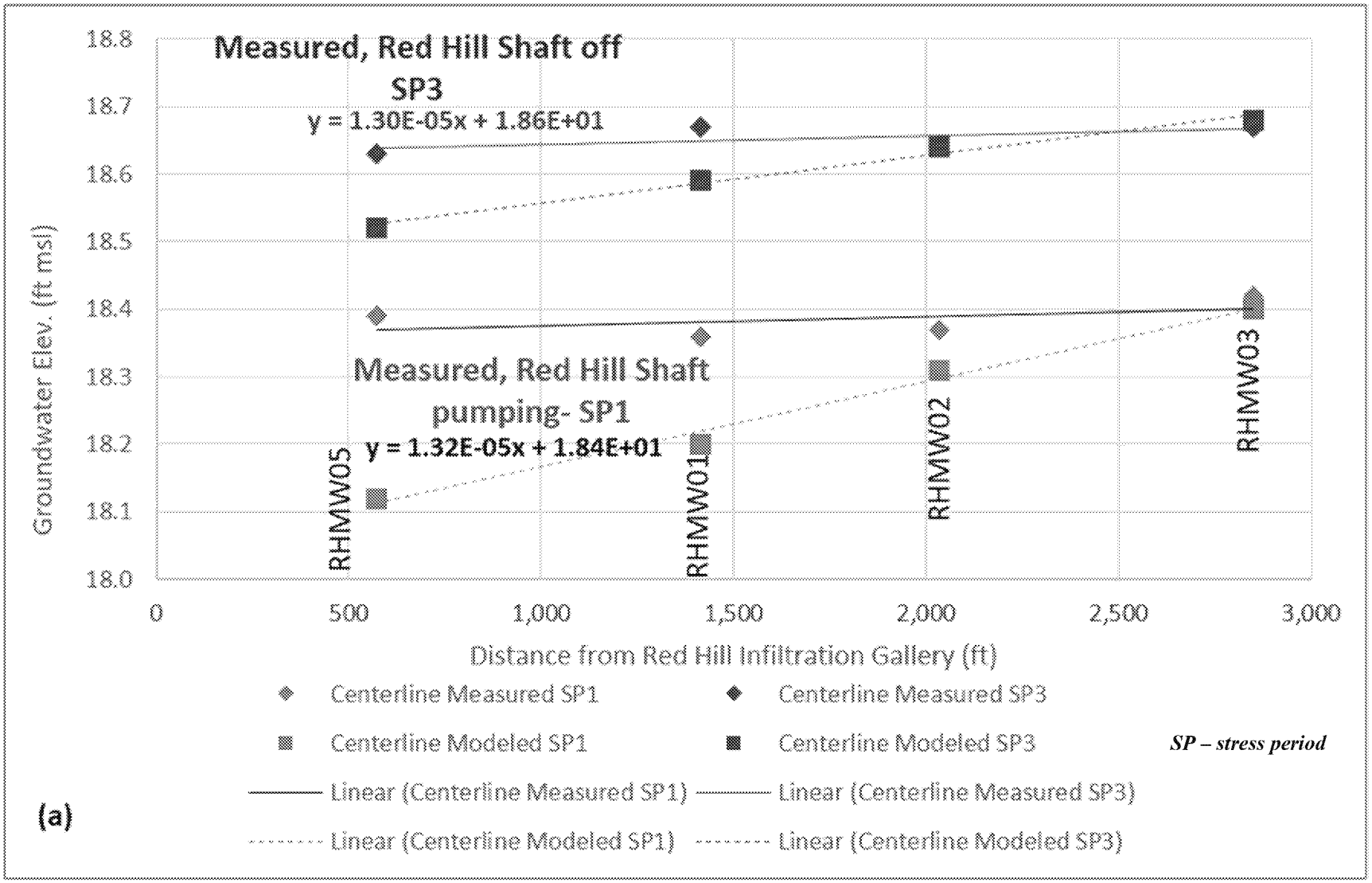


Prior Key Parameters v. Navy Models

	Oki, 2005			Navy GWFM - avgs		
Hydrostratigraphic Unit	Kv	Kt	Kl	Kv	Kt	Kl
Volcanic-rock aquifer	7.5	1,500	4,500	65	1,000	2,999
Caprock, upper-limestone unit	25	2,500	2,500	0.01	500	500
Caprock, low-permeability unit						
Above Waianae Volcanics	0.3	0.3	0.3	0.01	1	1
Above Koolau Basalt, west of Waiawa Stream	0.01	0.01	0.01	0.01	1	1
Above Koolau Basalt, east of Waiawa Stream	0.6	0.6	0.6	0.01	1	1
Valley-fill barriers	0.058	0.058	0.058	0.01	1	1

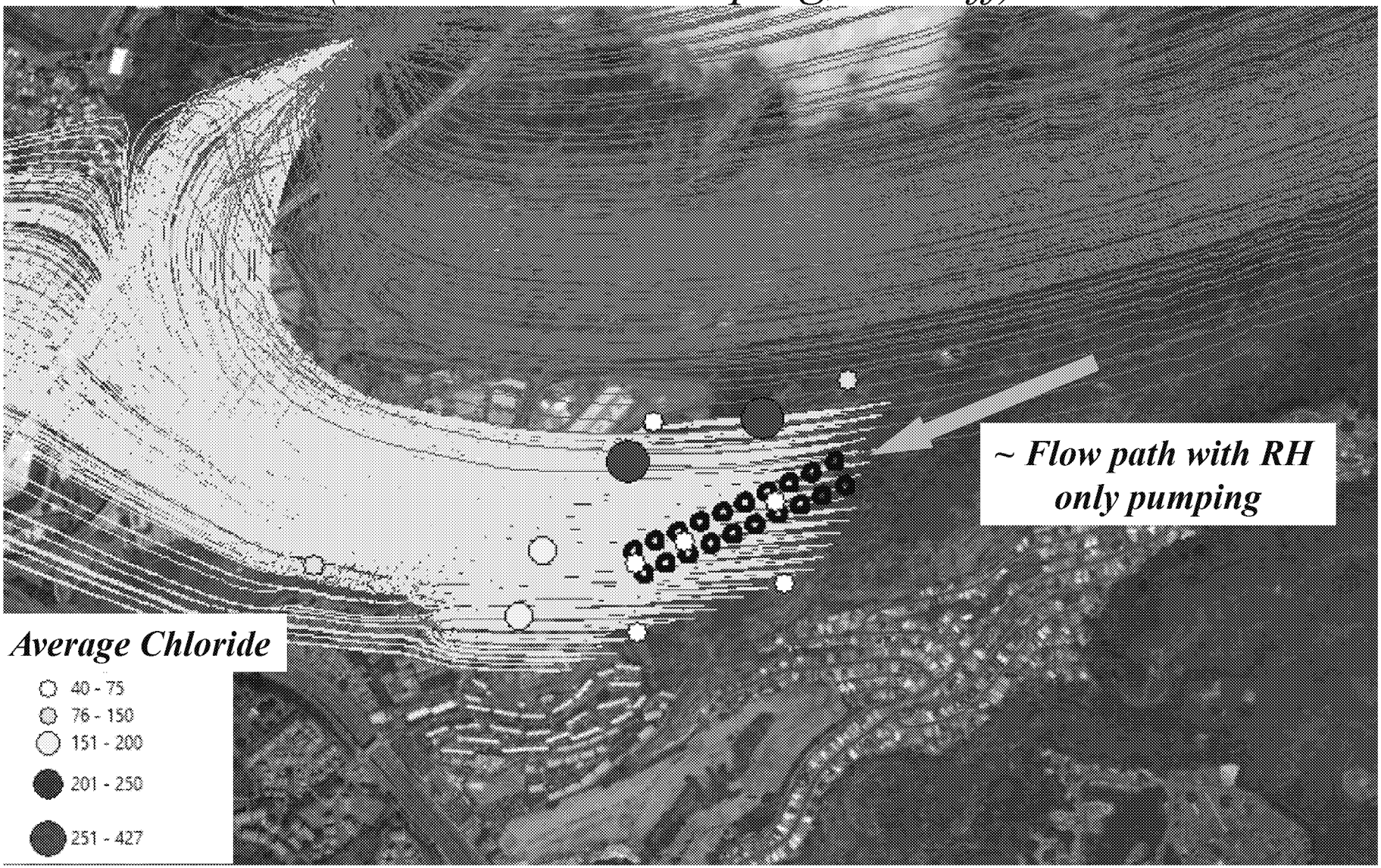
Modeled Gradients Are Too Large

(Red Hill area, no gradient change under pumping)

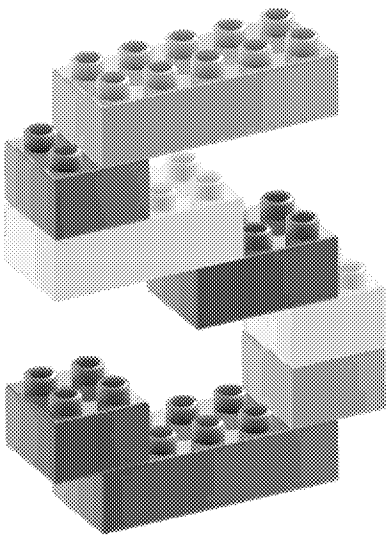


Chloride in Groundwater with Model 51A Paths

(BWS Halawa Pumping, RH Off)



Model Review Observations



- GWFMs do not match heads, diminishing reliability
  - In transient verification runs
  - Similar issue as in prior modeling (2007)
- GWFMs use atypical parameters for Hawaii aquifer
  - If retained, in depth justification needed
- GWFMs do not utilize geologic details – SSPA work
  - Impact of geologic heterogeneity needs further evaluation
- GWFMs do not comport with geochemistry
- GWFMs do not comport with well responses
- GWFMs capture zones not supported by field data at pumping rates similar to those modeled
  - Parameters selected overestimate capture potential
  - Gradient issues & complexity not covered
- As the GWFM's currently stand, they are not reliable
  - For CF&T, risk analyses and mitigation decisions