

New Vertical Datum for the Dead Sea Works, Israel 2008

Dan SHARNI, Israel



RESEARCH PROJECT for the Survey of Israel

Supported in part by the Dead Sea Works, Israel

Satellite view: Middle East



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 3

Satellite view: Israel



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 4

Satellite view: Dead Sea



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    TS 5C/Sharni: Dead Sea 5



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    TS 5C/Sharni: Dead Sea 6



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 7



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 8



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 9



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 10



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 11



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 12



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 13



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 14

Metzada



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 15

Herod's Palace



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 16

Canal



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 17



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 18

Hotels



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 19



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 20



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 21



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 22

Float!



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 23

Evaporation Ponds



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 24

Leveling Loops

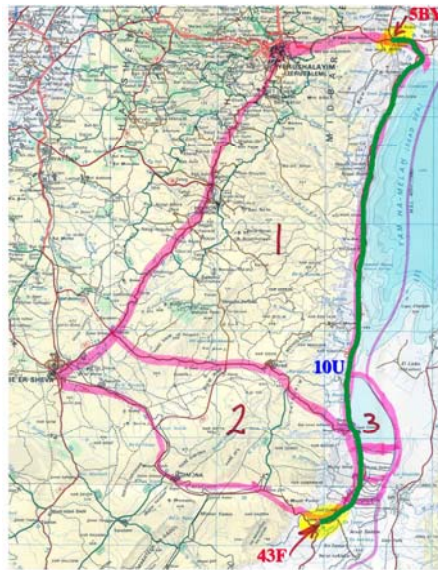
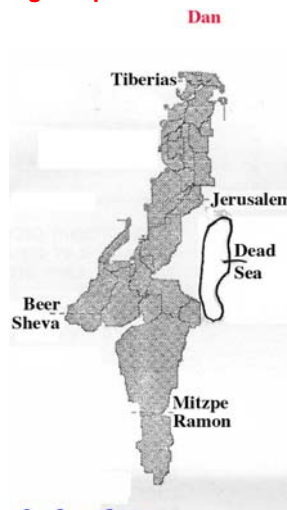


FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    TS 5C/Sharni: Dead Sea 25

National Leveling Loops



1st order loops



2nd order loops

Eilat

FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    TS 5C/Sharni: Dead Sea 26

Geoid for Israel

Geoid from LEVELING and GPS – or from GRAVITY.

- LEVELING** in Israel:
- MSL not accurate
 - Tie to the Net is tenuous
 - Observations over 50+ years
 - No proper Orthometric Correction
 - Not all loops included
 - No simultaneous Adjustment
 - (Hierarchic forcing of 2nd degree into 1st)
- GPS** (for Elevations) in Israel:
- Not same epochs as leveling (obviously)
 - Short-period observations
- GRAVITY:**
- UNB Geoid Program Suite
 - (modified Stokes-Helmert procedure)
 - [EGM2008]

FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009



TS 5C/Sharni: Dead Sea 27

GPS Control

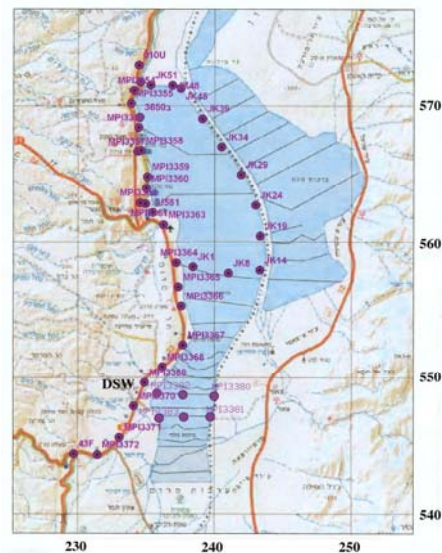
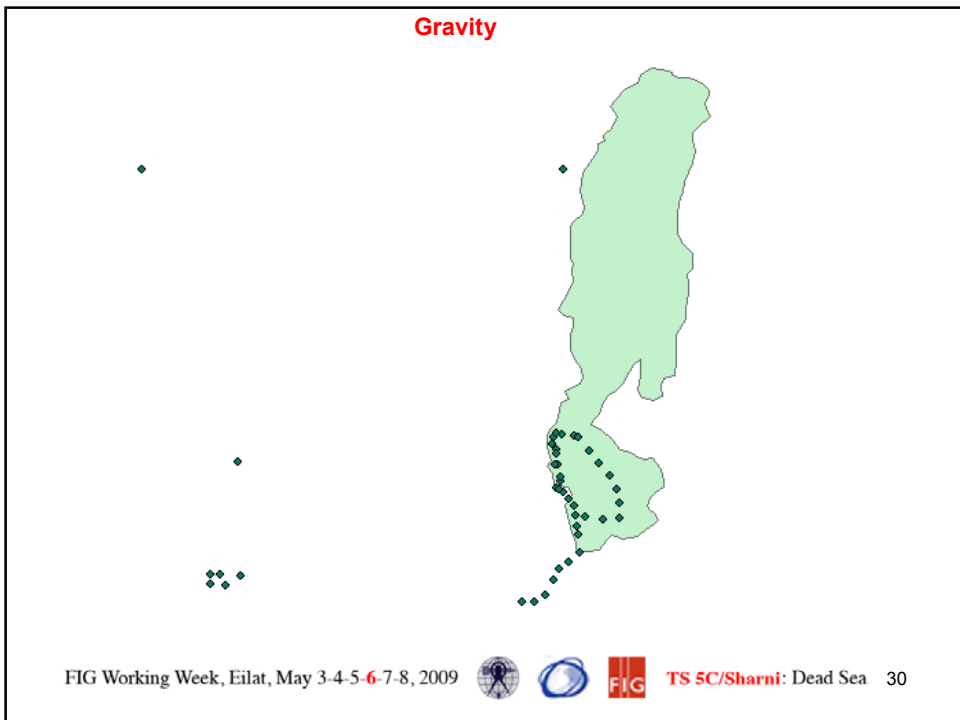
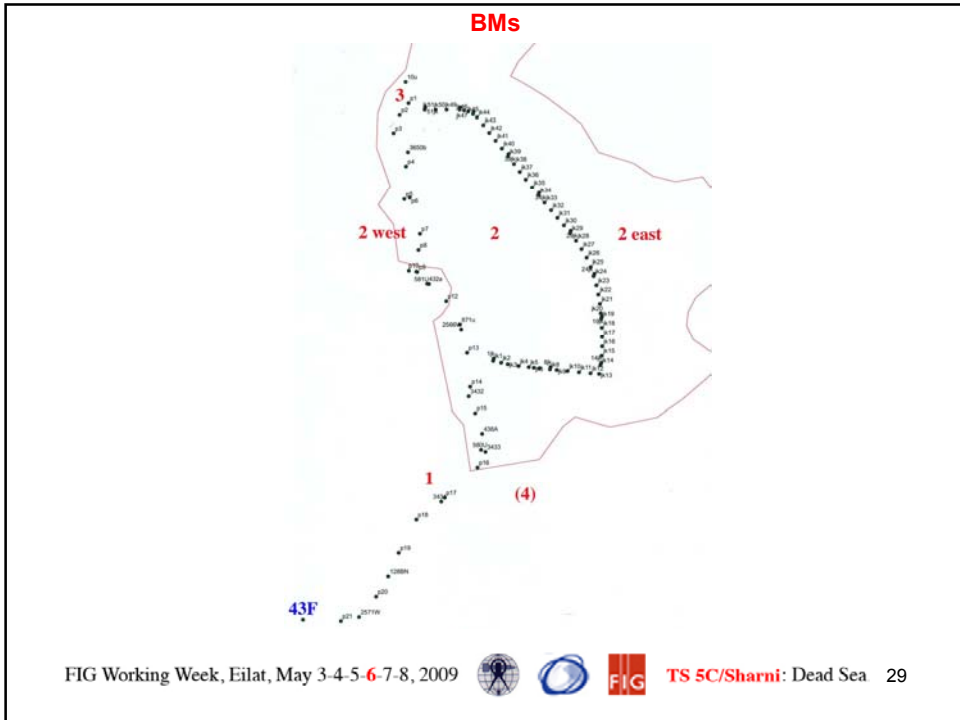


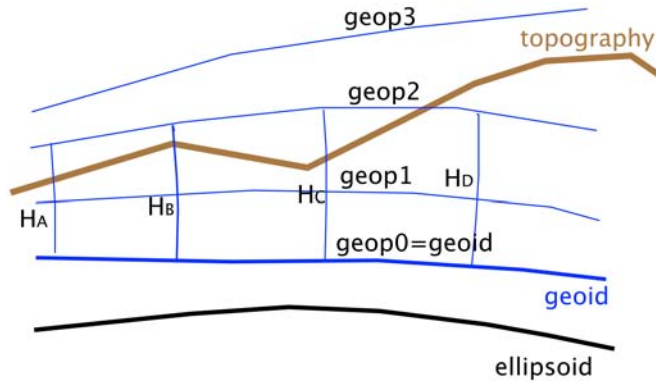
FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009



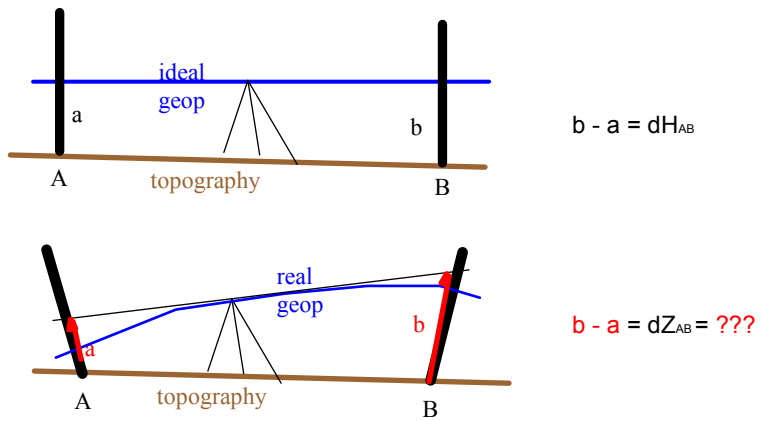
TS 5C/Sharni: Dead Sea 28



Leveling and Gravity - 1



Leveling and Gravity - 2



Orthometric Correction

Correction for non-parallelism of the Verticals:

Normal - Ellipsoidal gravity field; effect only in N-S direction

- size from -0.1 to +0.7 mm per leveling line (2-3 km) in the Project.

Gravimetric - Actual gravity field; in any direction; usually much bigger

- size from -7.2 to +8.3 mm per leveling line (2-3 km),

- where 2nd deg. tolerance is $4_{mm} \sqrt{L_{km}}$, or 6-7 mm per line;

- the cumulative Change in Elevations was (from 0 to) +43 mm (SOI higher; Project heights based on one point only);

- Undulations Changed from -77 to +120 mm (Project higher).

ROAD 3 - OPEN H from P1 - going north

Point	also	SOI (m)	phi	lambda	norm.corr. (mm)	H w.norm.corr. (m)	Y app. (m)	X
P6	3358MPI	-386.946	31.1927	35.3633	0.0	-386.978	234568	566699
P7	3359MPI	-385.717	31.1753	35.3681	0.5	-385.749	235030	564772
P8								

Point	g (mgal)	h wgs84 (m)	ΔZ (m)	ort.corr. (mm)	H ortho (m)	N 2008 (mm)	N I LUM1.2 (m)	precision (m)
P6	979445	-370.432	33.347		4	-386.980	16.548	16.428
P7	979437	-369.282	-1.229	1	-385.755	16.473	16.370	0.040
P8								

FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009



TS 5C/Sharni: Dead Sea 33

Undulations, N (DSW Datum2008)

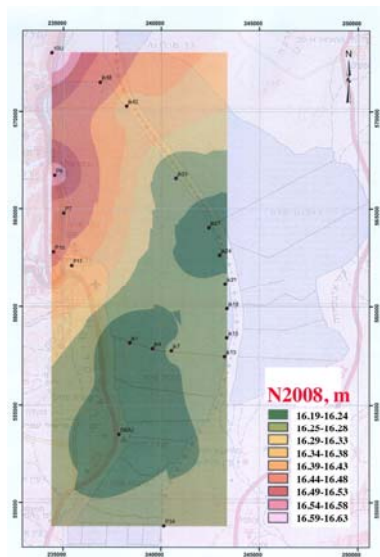


FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009



TS 5C/Sharni: Dead Sea 34

ΔN (Datum2008 – SOI)

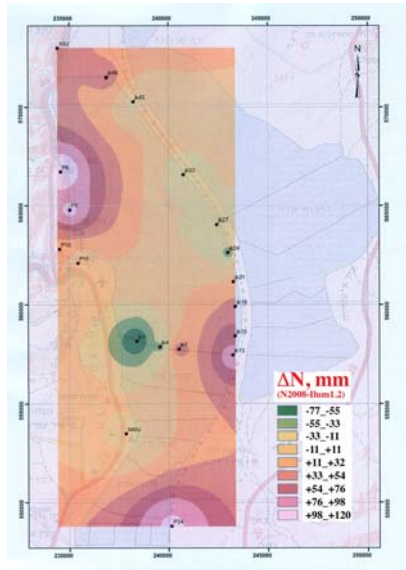


FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    TS 5C/Sharni: Dead Sea 35

ΔH (Datum2008 – SOI)

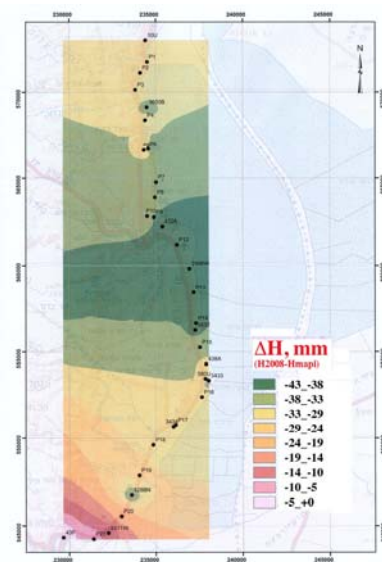


FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    TS 5C/Sharni: Dead Sea 36

Challenges for the Dead Sea

Lowering Sea Level

- Seashore moves East; beaches get farther from hotels
- DSW needs to channel water from North basin to evaporation ponds
- DSW needs to elevate dykes and excavate salt from ponds
- Hotel beaches need dyke protection, from elevated ponds

Settlement and Sinkholes

- Caused by sweet water dissolving salt layers, and salt water eroding silt layers
- Hotels are settling; damage forecast
- Sinkholes limit operations; dangerous even to pedestrians

FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009



TS 5C/Sharni: Dead Sea 37



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009



TS 5C/Sharni: Dead Sea 38



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 39

Ahhh...



FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009    **TS 5C/Sharni: Dead Sea** 40



THANK YOU.

SHALOM!

FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009



TS 5C/Sharni: Dead Sea 41