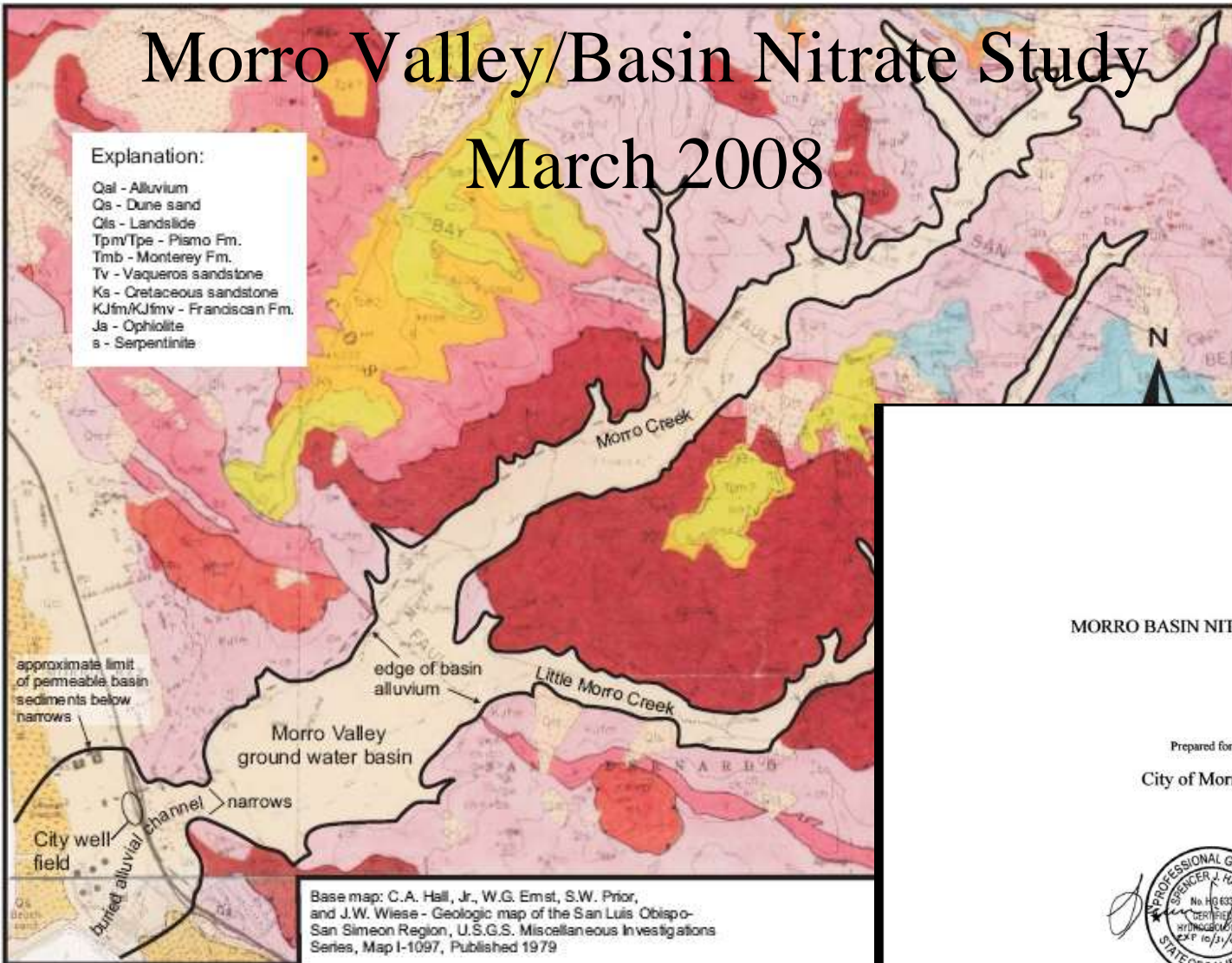


Morro Valley/Basin Nitrate Study

March 2008

Explanation:

- Qal - Alluvium
- Qs - Dune sand
- Qls - Landslide
- Tpm/Tpe - Pismo Fm.
- Tmb - Monterey Fm.
- Tv - Vaqueros sandstone
- Ks - Cretaceous sandstone
- KJfm/KJfmv - Franciscan Fm.
- Ja - Ophiolite
- s - Serpentinite



approximate limit
of permeable basin
sediments below
narrows

edge of basin
alluvium

Morro Valley
ground water basin

narrows

City well
field

buried alluvial channel

Base map: C.A. Hall, Jr., W.G. Ernst, S.W. Prior,
and J.W. Wiese - Geologic map of the San Luis Obispo-
San Simeon Region, U.S.G.S. Miscellaneous Investigations
Series, Map I-1097, Published 1979

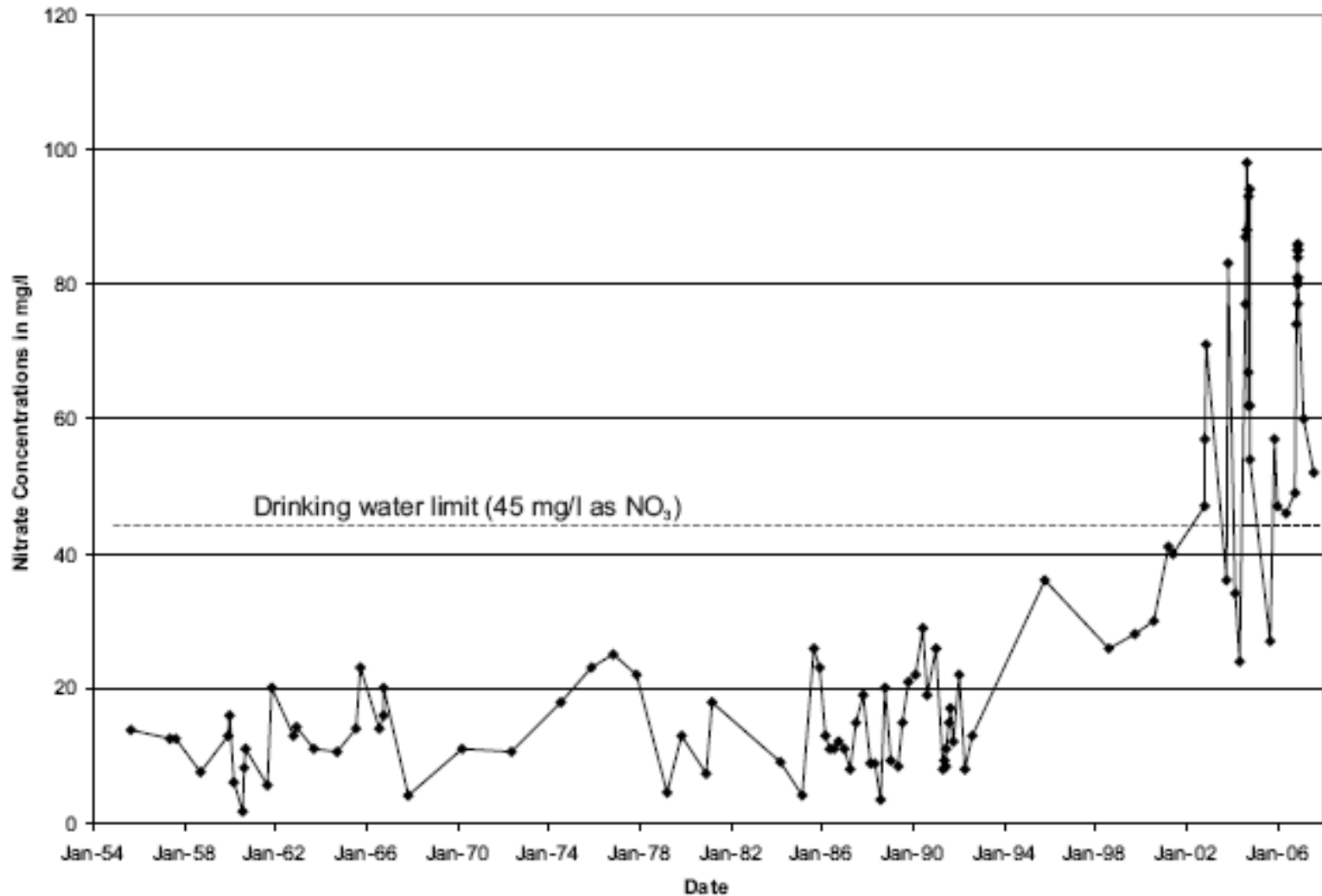


MORRO BASIN NITRATE STUDY

Prepared for the
City of Morro Bay



Morro Bay Wells Historic Nitrate Levels



Growth in Irrigated Acreage 1997-2007

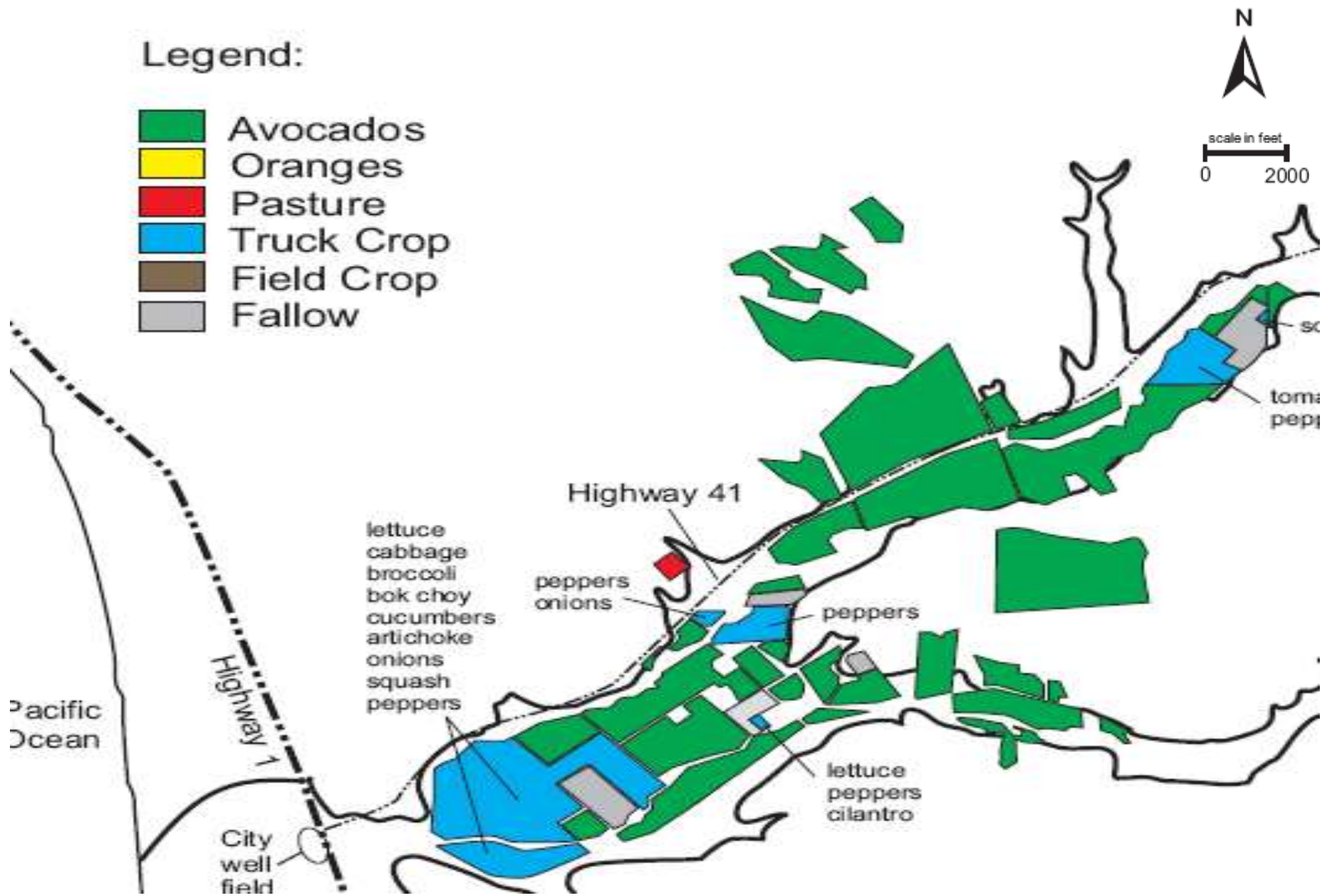
Table 1
Irrigated Acreage 1977-2007
Morro/Little Morro Creek Valleys

Crop Type	Irrigated Acreage					
	1977	1984	1992	1995	2001	2007
Truck (except legumes)	35	48	150	167	151	174
Legumes	11	89	228	371	193	--
Field	70	69	--	--	--	6
Pasture	61	57	10	18	9	5
Orchard	59	187	258	361	562	798
Total	236	450	646	917	915	983

Notes: Orchard planting is not restricted to the valley floor.

Survey by DWR in 1977, 1984 and 1995.

Survey by Cleath & Associates in 1992, 2001, and 2007 w/ assistance from County records.

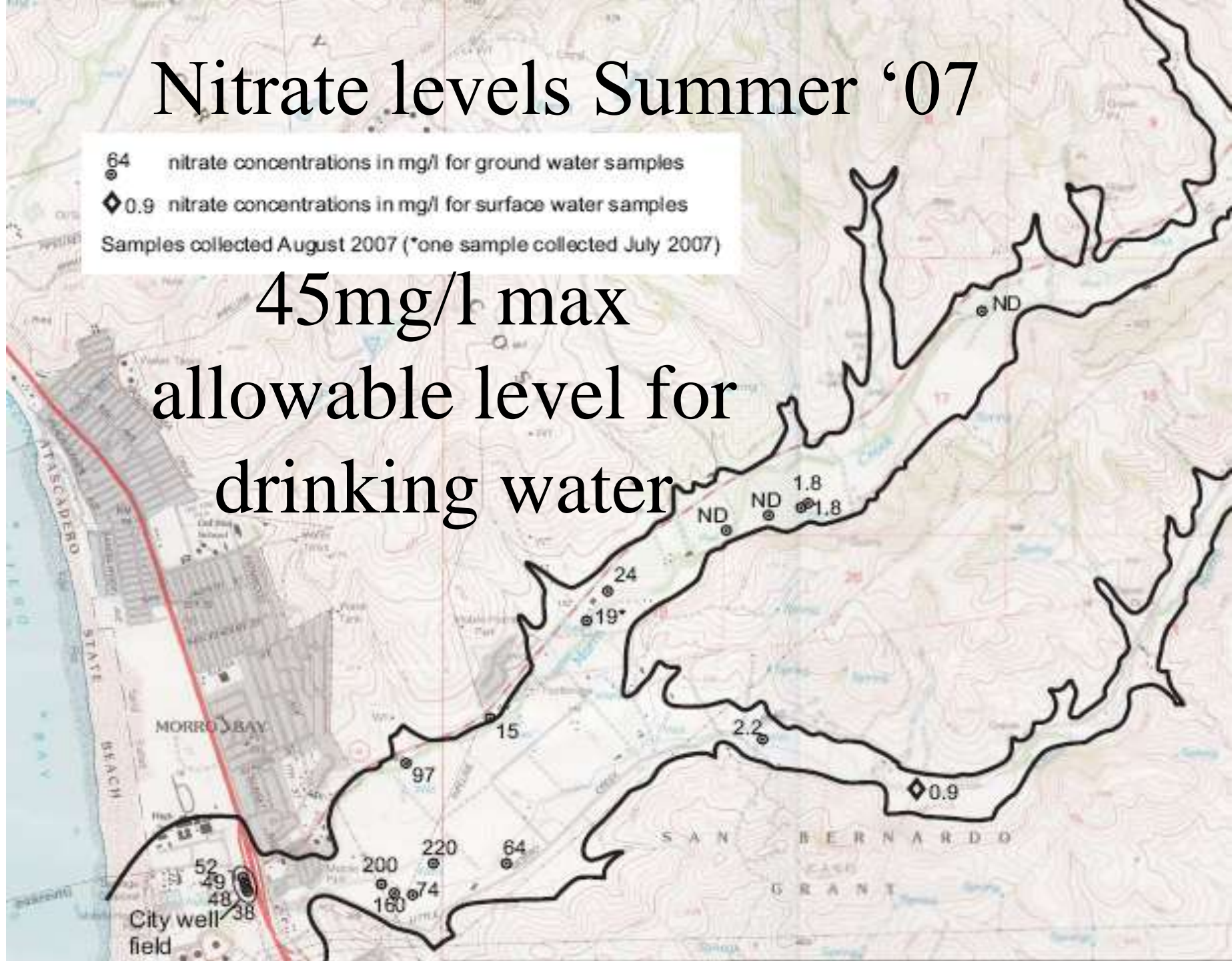


Current land usage in the valley

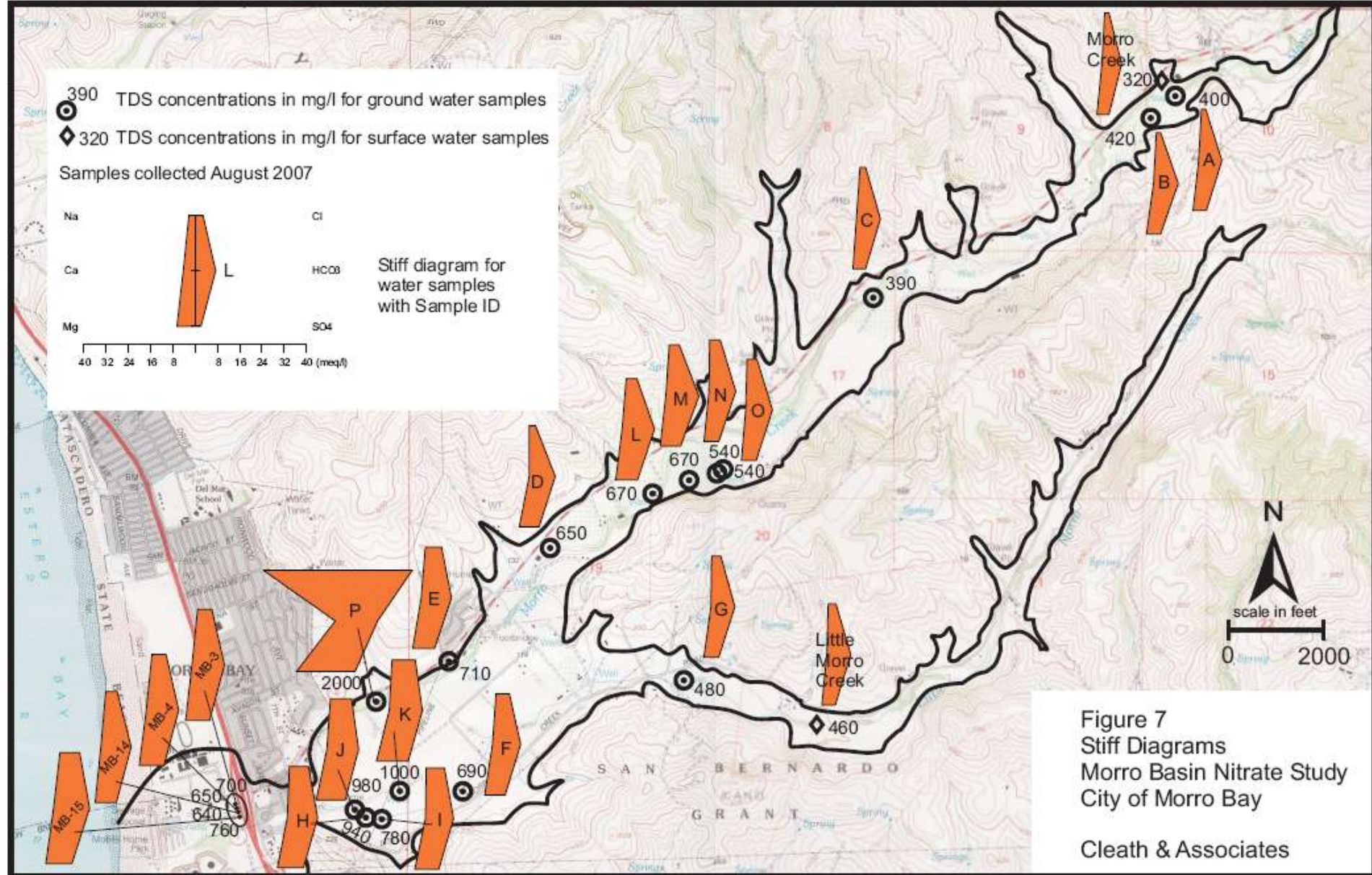
Nitrate levels Summer '07

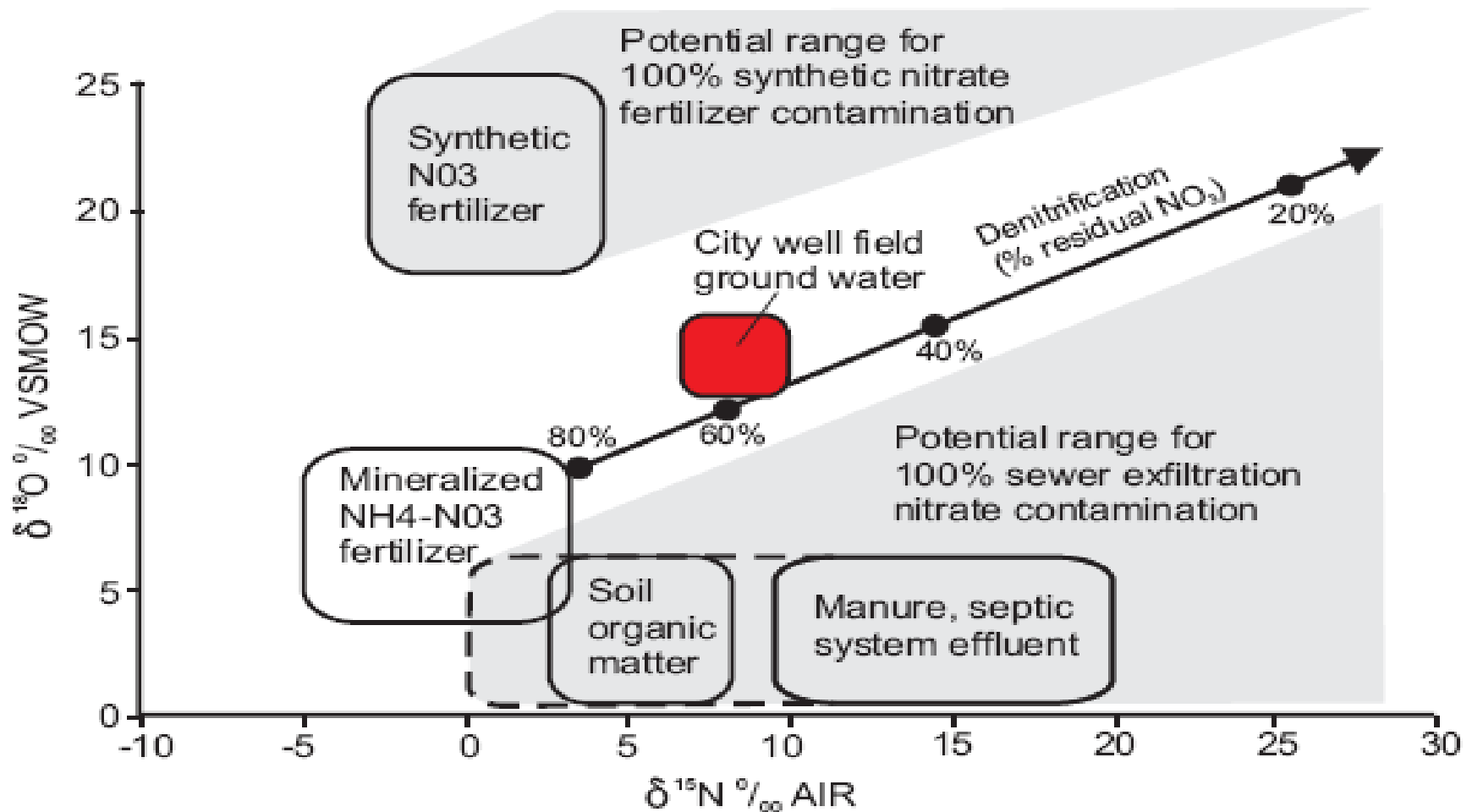
64 nitrate concentrations in mg/l for ground water samples
◇ 0.9 nitrate concentrations in mg/l for surface water samples
Samples collected August 2007 (*one sample collected July 2007)

45mg/l max
allowable level for
drinking water



Morro Valley general Groundwater mineral composition





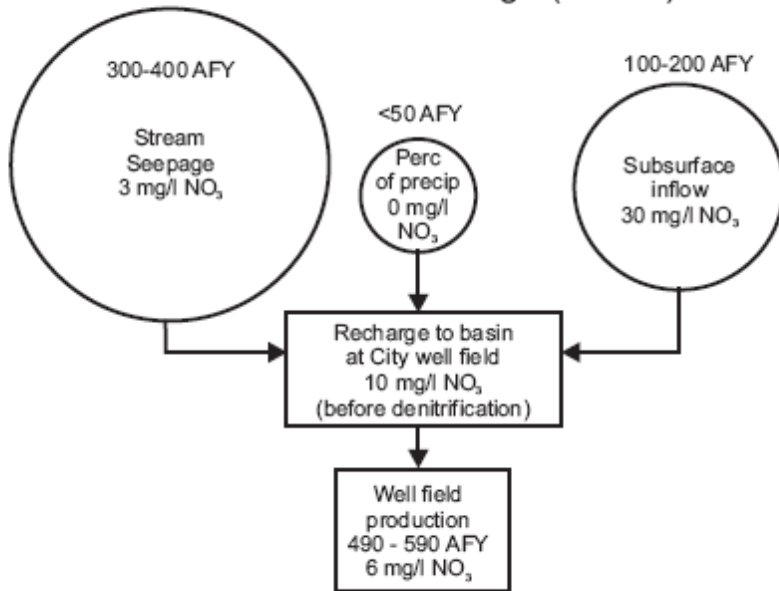
Modified from Clark and Fritz (1997) to extend range of septic system / sewer exfiltration based on Kendall (1998)

$\delta^{18}\text{O}$ values for nitrate vary according to the values of local ground waters. Ranges shown are for ground water with $\delta^{18}\text{O} (\text{H}_2\text{O})$ values of -10 ‰ (Clark and Fritz, 1997).

Isotope Testing

Figure 14
Isotope Data Interpretation

Historical Recharge (1980's)



Current Conditions

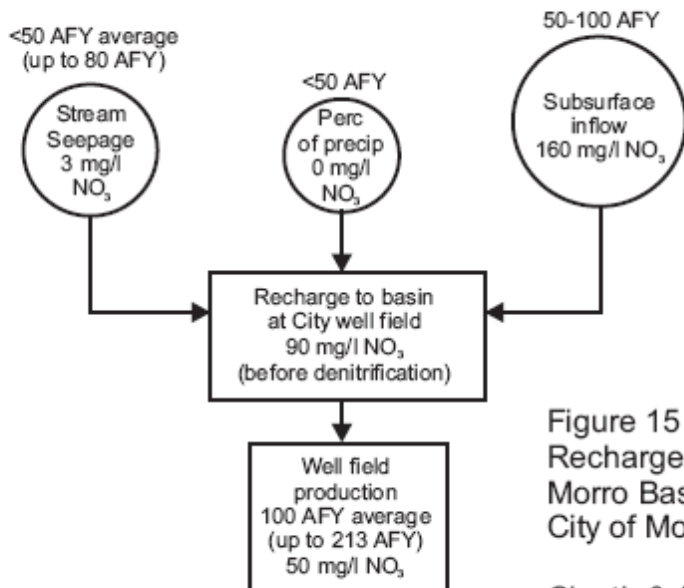


Figure 15
Recharge Dynamics
Morro Basin Nitrate Study
City of Morro Bay

Cleath & Associates

Future Steps

- Morro Bay is installing nitrate treatment equipment
- Once the equipment is in place, wells can be run to increase flushing action of aquifer
- Morro Bay is looking to the farm community to manage their nitrate contribution to the ground water basin.
- Questions?