

COMPONENTS & BENEFITS of PROPERLY CONSTRUCTED WELLS

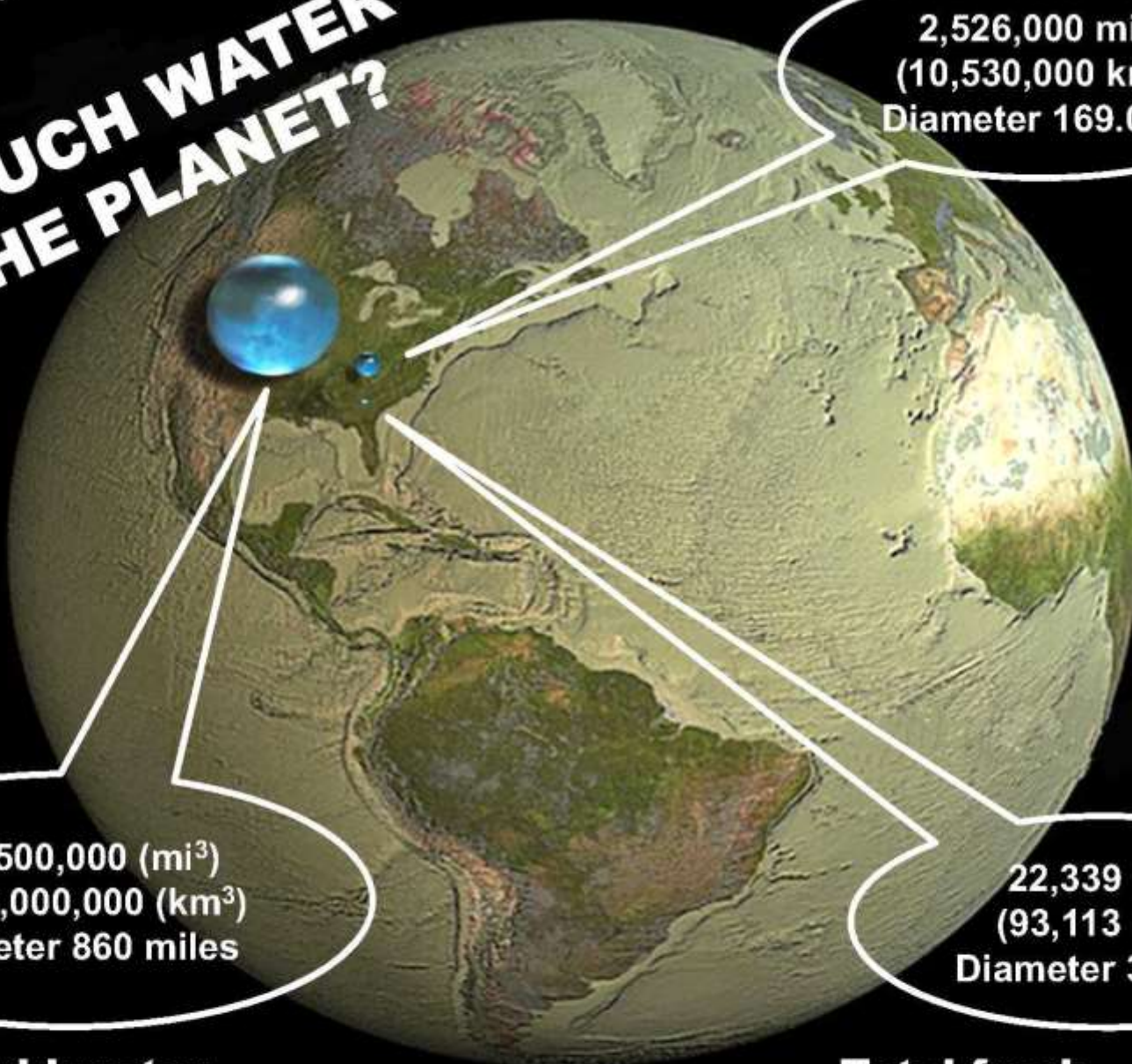
STEVE SCHNEIDER
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Past President & Director
National Ground Water Research & Educational Foundation
Charitable arm of the NGWA

VP - Drilling Operations
Schneider Water Services



HOW MUCH WATER ON THE PLANET?



2,526,000 mi³
(10,530,000 km³)
Diameter 169.0 mi

**Total
fresh
ground
water**

332,500,000 (mi³)
(1,386,000,000 (km³))
Diameter 860 miles

Total world water

22,339 mi³
(93,113 km³)
Diameter 34.9 mi

**Total fresh
surface water**

NGWA: GLOBAL IMPORTANCE of GROUND WATER

“Water is essential for life, and ground water is estimated to constitute more than 95% of the global, unfrozen freshwater reserves.”

“...given ground water’s vast reserves and broad geographical distribution, its generally good quality, and its protection from seasonal fluctuations and contamination, ground water holds the promise to ensure future world communities an affordable and safe water supply.”

[December 15, 2005, Emphasis added] www.ngwa.org



- Developing Countries Interest Group (DCIG)
M. Campana initiated 2005 – SRO meeting
- Research & Educational Foundation (NGWREF)
 - Charitable arm of NGWA
 - “...focused on conducting educational, research, and other charitable activities related to a broader understanding of groundwater.”
 - Funds: Darcy, McElhiney, DN, USA, research, scholarship & general
 - DN: GW project grants and Education & Training

WHY PROPER WELL CONSTRUCTION?

“You will never solve poverty without solving water and sanitation” *Matt Damon - interview with Katie Couric*

“You will never solve sanitation without water free of harmful pathogens” *S³*

“... 1.8 billion people globally use a source of drinking water that is faecally contaminated...” *Progress on Drinking Water and Sanitation – 2014 update – WHO & UNICEF*

Q: WHY PROPER WELL CONSTRUCTION?

A: SAFETY & SUSTAINABILITY

- Public Safety - Safe v clean drinking water
Goal is SAFE = ZERO E-coli (<1/100ml)
& within guidelines for other minerals/chemicals
- Safety: Those constructing (e.g. dug wells)
- Up to 80% non-functioning in SSA
- Groundwater resource protection – quantity and quality (future generations)

‘Hand dug or excavated wells pose significant concern for the safety of those constructing, maintaining and using such wells.

...the difficulty of constructing and maintaining a sanitary supply using the dug well technique argue against the practice’



USGS & CDC studies find dug wells more likely to be FIB contaminated.

Quality of Water from Domestic Wells in Principal Aquifers of the United States 1991-2004 USGS
A Survey of the Quality of Water Drawn from Domestic Wells in Nine Midwest States CDC



EVOLUTION of GUIDELINES

- 2008 NGWA DCIG presentations - ‘Well’ intentioned groups/individuals doing less than swell construction
- 2009-10 1st, 2nd, 3rd drafts
 - Panama, WaTER, NOLA, AWRA, LV, email etc
 - Circ. to 1000’s; 100’s of suggestions included
- 2011 4th draft & First Edition @ WaTER
- 2012 Second Edition – OSU = CBA added. EWB conference @ Cal Poly
- 2013 Swahili translation – WEDC Kenya, RWSN dnlds, NGWA, etc.
- 2014 Third Edition – Chinese, Spanish & French
 - WEDC, UNC, EWB Panama and National, GSA, NGWA

**MWONGOZO WA KISIMA
CHA KUSAMBAZA MAJI**



**kwa matumizi katika
NCHI ZINAZOSTAWI**

**Available in 5 languages:
Second Edition – Swahili
Third Edition – all others**

**DIRECTRICES PARA
POZOS DE
ABASTECIMIENTO DE AGUA**



**para usar en
PAÍSES EN DESARROLLO**

TERCERA EDICIÓN

**WATER SUPPLY WELL
GUIDELINES**



**for use in
DEVELOPING COUNTRIES**

THIRD EDITION

**供水井
指南**



供发展中国家使用

第三版

**DIRECTIVES
POUR LES PUITES
D'ALIMENTATION EN EAU**



**destinés à être utilisés dans les
PAYS EN VOIE
DE DÉVELOPPEMENT**

TROISIÈME ÉDITION

GUIDELINE USES

- Field crews – Drillers / Hydrogeologists
- NGOs (training & specifying)
- Gov regulatory agencies (create standards)
- Gov aid agencies (procurement specs)
- Reference resource
 - WEDC library - UK
 - RWSN - Swiss
- Course text / workbook
 - US and International universities / academia
 - Kenya, Vietnam, Malawi & other workshops
 - Impacting the construction of 1000's of wells
 - Potential impact: Millions of users (10's / 100's of millions)

KEY COMPONENTS

- Location, location, location
 - Set backs
 - Three dimensional
- Annular seal
 - Mandatory
 - Chip bentonite
 - Commingling
- Documentation – well logs
 - Facilitates O&M
 - Used by drillers, hydrogeologists
 - Locate other well sites
 - Design other wells
 - Facilitate drilling plans for other wells
 - Aquifer characterization
 - Reposited & accessible



WATER SUPPLY WELL REPORT

Well ID # / Name _____ Location of ID on well _____

(1) OWNER: Land _____ User _____ Both _____
 State _____
 Address _____

(2) TYPE OF WORK
 New Well Deepening Abandon (repair/recessed) Decommissioning

(3) DRILL METHOD:
 Rotary Air Rotary Mud Cable
 Other _____

(4) PROPOSED USE:
 Domestic Community Industrial Irrigation
 Thermal Injection Livestock Other _____

(5) BORE HOLE CONSTRUCTION:
 All Depths Are in _____ Meters _____ Feet Below Ground Surface
 Depth of Completed Well _____ Meters _____ Feet

BORE HOLE		MATERIAL		BACKS OR GRADE	
Diameter	From To	From To	Material	From To	Backs or grade

How was seal placed _____

Backfill placed from _____ to _____ Material _____
 Filter pack placed in _____ to _____ Size of pack _____

(6) CASING/LINER:
 Diameter From To Gauge Steel Plastic Welded Threaded
 Casing: _____
 Liner: _____

Drive Shoe used Inside Outside None
 Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS:
 Perforations Method _____ Material _____
 Screens Type _____

From To	Shot size	Number	Diameter	Teleprobe size	Casing	Liner

(8) WELL TESTS: Minimum testing time is 1 hour
 Pump Bailer Air Flowing Artesian
 Yield gallons _____ Drawdown _____ Drill stem at _____ Time _____

(9) LOCATION OF WELL GPS:
 Latitude _____ Longitude _____
 Other (legal or locally used documentable location description): _____

(10) STATIC WATER LEVEL:
 Arterian pressure _____ below land surface. Date _____
 _____ PSI _____ Draw _____

(11) WATER BEARING ZONES:
 Depth at which water was first found _____

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:
 Ground Elevation _____

Material	From	To	SWL

Date started _____ Completed _____

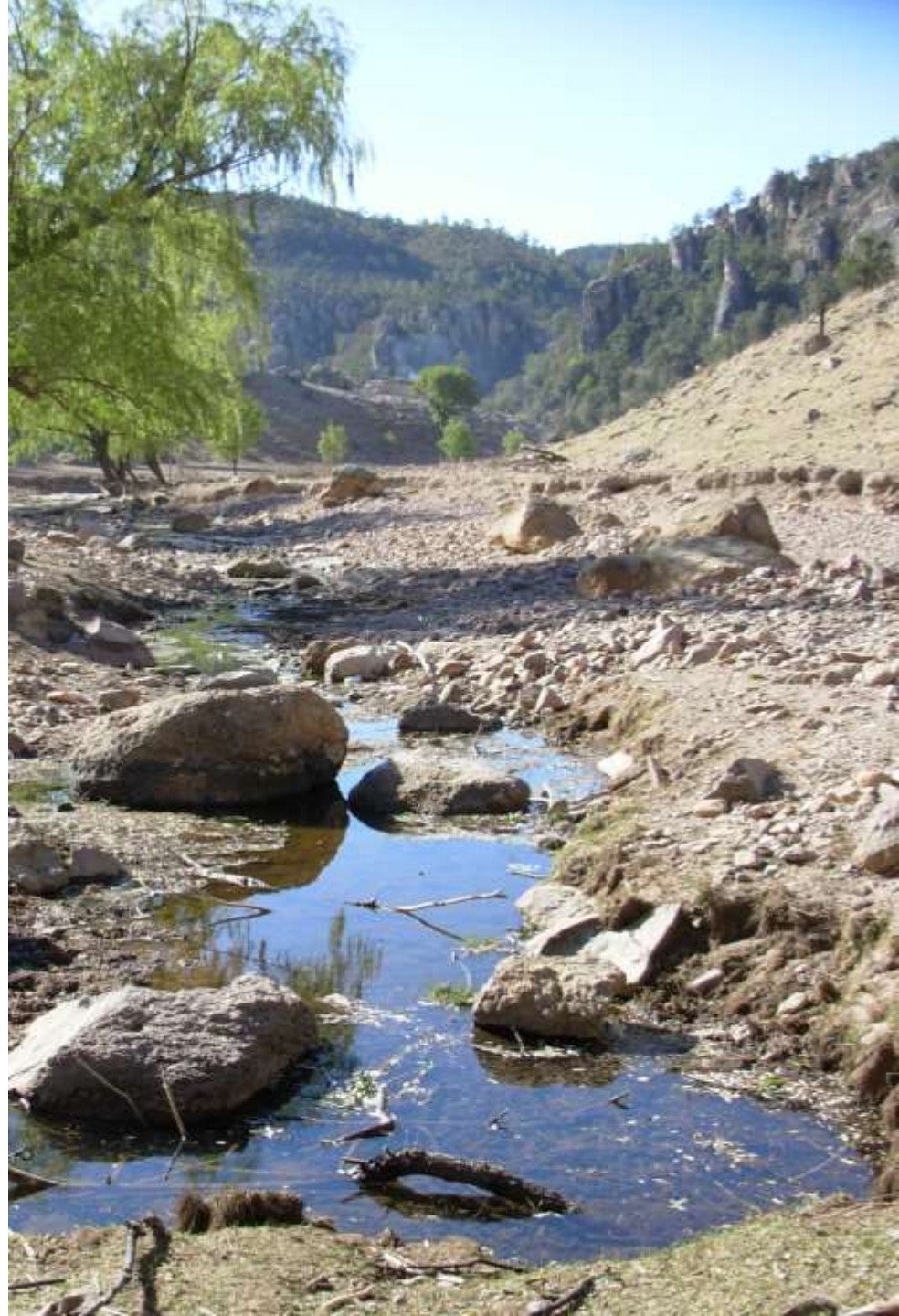
Person or Organization responsible for well's construction:
 Name _____
 Address _____
 Phone # _____ E-mail _____

LOCATION



LOCATION

LOCATION



WELL LOCATION

FIGURE 1

WELL SETBACKS



minimum 30m [98ft]

minimum 15m [49ft]

minimum 30m [98ft]

minimum 150m [490ft]

minimum 150m [490ft]

minimum 30m [98ft]

ANNULAR SEAL

- MANDATORY – 1 of 2 (zero e-coli is other)
- Most important component physically incorporated into a well's construction
- Well construction - NOT FOR AMATEURS
- Installation can be very challenging
 - Deep seals (e.g. through shoes)
 - Flowing conditions (whether at surface or not)
 - Removing temporary casing(s)

SEALANT CHARACTERISTICS

	CEMENT	CONCRETE	CHIP BENTONITE
FLUID (fills cracks / loses circ)	YES	YES	NO
HEAT of HYDRATION	YES	some	NO
SHRINKS DURING CURING	YES	some	NO
PUMPABLE DOWN HOLE	YES	Difficult	NO
DILUTES if POURED THRU H2O	YES	YES	NO
POTENTIAL BRIDGING	NO	YES	YES
MAY CRACK	YES	YES	NO
RE-SWELLABLE	NO	NO	YES
FAULT AT ADD'L PLACEMENTS	YES	YES	NO

Sealant with most positive feature has answer in bold and cell highlighted.

DOCUMENT

DOCUMENT

PADRE VERBALAN

DOCUMENT

WATER SUPPLY WELL REPORT

Well ID # / Name _____ Location of ID on well _____

(1) OWNER Land _____ User _____ Both _____

(2) LOCATION OF WELL GPS _____
 Address _____ Latitude _____ Longitude _____
 Other (legal or locally used documentable location description) _____

(3) TYPE OF WORK
 New Well Drilling Abandon (impairment) Determining

(4) DRILL METHOD
 Rotary Air Rotary Mud Cable
 Other _____

(5) PROPOSED USE
 Domestic Commercial Industrial Irrigation
 Thermal Geothermal Livestock Other _____

(6) ROPE HOLE CONSTRUCTION
 All depths are in _____ Meters _____ Feet Below Ground Surface
 Drilled Bored Cast in place

SHAFT	ROPE HOLE		MATERIAL	DIA.	DEPTH	REMARKS
	FROM	TO				

How was seal placed _____

Revised placed from _____ to _____ Material _____
 Size and used for _____ to _____ Size of pack _____

(7) CASING/LINER

CASING	DIA.	THICKNESS	MATERIAL	COATING	DEPTH	REMARKS

Does this well have No Yes Other None

(8) PERFORATIONS/SCREENS

PERFORATION/SCREEN	DIA.	THICKNESS	MATERIAL	COATING	DEPTH	REMARKS

(9) WELL TESTS: Minimum testing time is 1 hour
 Pump Bail Air Venturi Other _____
 Test pattern _____ Interval _____ Well size at _____ ft _____

Disposition of water _____ Degree _____
 How is water sample stored? Yes, by whom _____
 Did any other casing water not suitable for sampling? Yes No
 Only Daily Other Other Other
 Depth of water _____

(10) STATIC WATER LEVEL
 Actual pressure _____ PSI _____ Date _____
 Other (legal or locally used documentable location description) _____

(11) WATER BEARING ZONES
 Depth at which water was first found _____

FROM	TO	ESTIMATED FLOW RATE	SWL

(12) WELL LOGS

MATERIAL	FROM	TO	SWL

Drawn _____ Compiled _____

Person or Organization responsible for well's construction
 Name _____
 Address _____
 Phone # _____ E-mail _____

DOCUMENTATION

- Field notes (detailed daily records) required
 - By rule of law
 - By whoever is funding project
- Well label or tag
 - Government issued or if not format and ID specified by whoever funds project.
 - Designed to outlive well (e.g. 300 series SS)
 - Permanently affixed (welded, impeded in concrete, SS strap)
 - ID entered onto well record

SCHNEIDER WATER SERVICES - DAILY DRILLING REPORT

Tom & Sally Smith - W.O. xxxx

NAME	ARRIVE	DEPART	OFF DUTY	TRAVEL	VEHICLE(S)		BEGIN SHIFT	END SHIFT	NOTES (Incl: Bit sizes & types)
						HOLE SIZE:			
						DEPTH:			
						SWL(S):			
						RIG #:	RIG HOURS:	FUEL:	

GEOLOGIC AND DRILLING LOG

DEPTH		FORMATION MATERIAL DESCRIPTION	GW INFO (Flow rates, water levels)	DRILLING ACTION (speed, caving, etc.)
FROM	TO			

RECORD OF WORK PERFORMED

CASING/LINER @ END OF SHIFT

TIME		DESCRIPTION (e.g. drilling, developing, repairs, etc.)	DIAMETER	WALL THICKNESS	FROM	TO	TOTAL LENGTH
FROM	TO						

MATERIALS USED (e.g. casing added/removed; grout; dev. chem.)	DRILLER / SUPERVISOR
	DAY & DATE
	WELL # Start Card xxxx
	REPORT #

Daily Report & Well Tag Examples



WELL RECORD

- MOST IMPORTANT RECORD OF ALL!
- Well location by at least two methods
 - GPS
 - Legal property description or other?
- Well ID (same as on well tag / label)
- Well owner or user (identify which one)
- Well constructor's name / organization
- Depth drilled & depth of completed well
- See book for more...

WATER SUPPLY WELL REPORT

Well ID # / Name _____

Location of ID on well _____

(1) **OWNER:** Land _____ User _____ Both _____
 Name _____
 Address _____

(2) **TYPE OF WORK**
 New Well Deepening Alteration (repair/upgrade) Decommissioning

(3) **DRILL METHOD:**

Rotary Air Rotary Mud Cable
 Other _____

(4) **PROPOSED USE:**

Domestic Community Industrial Irrigation
 Thermal Injection Livestock Other _____

(5) **BORE HOLE CONSTRUCTION:**

All Depths Are in _____ Meters _____ Feet Below Ground Surface

Depth of Completed Well: _____

BORE HOLE			SEALS			
Diameter	From	To	Material	From	To	Backs or pounds

How was seal placed? _____

Backfill placed from _____ to _____ Material _____
 Filter pack placed from _____ to _____ Size of pack _____

(6) **CASING/LINER:**

Diameter	From	To	Gauge	Steel	Plastic	Wellhead	Threaded
Casing:				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Liner:				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Drive shoe used Inside Outside None

Final location of shoe(s) _____

(7) **PERFORATIONS/SCREENS:**

Perforations Method _____ Material _____
 Screens Type _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>

(8) **WELL TESTS:** Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem at	Time

Temperature of water _____ Degrees C _____ F _____
 Was a water analysis done? Yes By whom _____
 Did any strata contain water not suitable for intended use? Too little
 Silty Muddy Odor Colored Other _____
 Depth of strata _____

(9) **LOCATION OF WELL:** GPS: _____

Latitude _____ Longitude _____
 Other (legal or locally used documentable location description): _____

(10) **STATIC WATER LEVEL:**

_____ below land surface. Date _____

Artesian pressure _____ psi PSI _____ Date _____

(11) **WATER BEARING ZONES:**

Depth at which water was first found _____

From	To	Estimated Flow Rate	SWL

(12) **WELL LOG:**

Ground Elevation _____

Material	From	To	SWL

Date started _____ Completed _____

Person or Organization responsible for well's construction:

Name: _____

Address _____

Phone # _____ E-mail _____



DOCUMENTATION SUBMISSION

- Logs (reports) must be a requirement
 - By whoever is funding the project
 - Final payment (retainage) pending submission and approval of completeness and acceptable accuracy.
 - By rule of law
 - Enforced by civil penalty and/or license revocation or suspension - \$ rules
- Storage and retrieval for all, especially:
 - Drillers
 - Hydrogeologists, geologists, scientists & engineers







RESULTS



BENEFITS (Prompted by BIG Q)

- ❖ **Shouldn't a well be constructed asap, even if resources aren't available to properly build it, in order to get some immediate result - e.g. lives saved?**

or...

- ❖ **Won't more lives be compromised as a result of inferior construction?**

Safety & Sustainability will be compromised.

- Adds to 1.8B with fecal contaminated source.
- Safety incident on your watch; how will you cope?

ADD'L RISKS / THOUGHTS re: BIG Q

- Inferior wells require decommissioning or repair at some time in future:
 - \$\$\$ to properly decommission / repair
 - Safety (open boreholes)
- Contamination from GW creates negative perception of the GW resource
 - One chance to make first impression
- Long term aquifer damage
 - GW becomes a problem, not a solution
- Short term solutions are available
 - e.g. ceramic pots, bio-sand filters, etc.

COST – BENEFIT ANALYSIS (CBA)

- June 2012 – OSU
- Jaynie Whinnery, BSME - EWB
- October 2012 – published & presented @ EWB regional, Cal Poly
- PDF on web – also spreadsheet



CBA Revelations

- Almost 40x more benefit than cost
 - If properly constructed, operated, maintained
- ~5X increase in net value with O&M
- Unacceptable: Building wells that will likely produce localized poor water quality – negative NPV (B:C ratio < 1)
- 3x-infinity more NPV: Proper well v Inferior well

CBA Presumption (not specifically analyzed)

UNACCEPTABLE: Well that results in GW contamination or aquifer damage:

- Surface water leaking in
- Commingling
- Uncontrolled artesian

NEGATIVE IMPACTS:

- Reduced large-scale benefits
- Added cost of remediation / mitigation

Such impacts will certainly result in a negative NPV

CBA – Customizable Spreadsheet

- Number of wells
- Number of users per well
- Construction costs
- Discount rate
- Percent of income used for water
- Local GNI-PPP
- Morbidity values
- Mortality values

NUMBERS for USA [Kenya] CBA

- People per well: 4 [250]
- Discount rate: 3% [same]
- Rural well drilling cost: \$11,850 [same]
- Submersible system: \$5000 [hand pump - \$1,800]
- Inferior well drilling cost reduction: 25% [same]
- O&M as percent of hardware: 1% [10%]
- GNI: \$48,890 [\$1,720]
- Income used for water: 1% [10%]
- Lives lost annually to diarrhea: 1 in 300,000,000 [2,343 in 300,000,000 (equivalent divisor)]
- Days lost per case of diarrhea: 1 [3]

CBA SUMMARY TABLE – Kenya

CBA Project Alternative	Total Benefits PDV	Total Cost PDV	Total NPV	Benefit/Cost Ratio
Proper Construction; With O&M	\$670,651	\$17,455	\$653,196	38.42
Inferior Construction; With O&M	\$206,445	\$12,583	\$193,862	16.41
Proper Construction; No O&M	\$167,560	\$14,876	\$152,684	11.26
Inferior Construction; No O&M	\$43,765	\$11,914	\$31,851	3.67
Inferior Construction; No O&M; Local GW Quality Compromised, No Treatment	\$0	\$11,914	-\$11,914	0
Inferior Construction; With O&M; Local GW Quality Compromised, No Treatment	\$0	\$12,583	-\$12,583	0
Inferior Construction; No O&M; Local GW Quality Compromised, Treatment Provided	\$43,765	\$171,601	-\$127,836	0.26
Inferior Construction; With O&M; Local GW Quality Compromised, Treatment Provided	\$206,445	\$765,845	-\$559,399	0.27

CBA SUMMARY TABLE – USA 4

CBA Project Alternative	Total Benefits PDV	Total Cost PDV	Total NPV	Benefit/Cost Ratio
Proper Construction; With O&M	\$30,757	\$24,596	\$6,161	1.25
Inferior Construction; With O&M	\$9,468	\$16,330	-\$6,862	0.58
Proper Construction; No O&M	\$7,685	\$17,434	-\$9,749	0.44
Inferior Construction; No O&M	\$2,007	\$14,472	-\$12,464	0.14
Inferior Construction; With O&M; Local GW Quality Compromised, Treatment Provided	\$9,468	\$16,523	-\$7,055	0.57
Inferior Construction; With O&M; Local GW Quality Compromised, No Treatment	\$0	\$16,330	-\$16,330	0.00
Inferior Construction; No O&M; Local GW Quality Compromised, Treatment Provided	\$2,007	\$14,513	-\$12,505	0.14
Inferior Construction; No O&M; Local GW Quality Compromised, No Treatment	\$0	\$14,472	-\$14,472	0.00

CBA SUMMARY TABLE – USA 250

CBA Project Alternative	Total Benefits PDV	Total Cost PDV	Total NPV	Benefit/Cost Ratio
Proper Construction; With O&M	\$1,922,333	\$57,547	\$1,864,787	33.40
Inferior Construction; With O&M	\$591,749	\$49,281	\$542,468	12.01
Proper Construction; No O&M	\$480,290	\$50,385	\$429,905	9.53
Inferior Construction; No O&M	\$125,448	\$47,422	\$78,025	2.65
Inferior Construction; With O&M; Local GW Quality Compromised, Treatment Provided	\$591,749	\$802,542	-\$210,794	0.74
Inferior Construction; With O&M; Local GW Quality Compromised, No Treatment	\$0	\$49,281	-\$49,281	0.00
Inferior Construction; No O&M; Local GW Quality Compromised, Treatment Provided	\$125,448	\$207,110	-\$81,662	0.61
Inferior Construction; No O&M; Local GW Quality Compromised, No Treatment	\$0	\$47,422	-\$47,422	0.00

MAKING A DIFFERENCE

GW Safety & Sustainability

- Influence pathogen safe construction - I well for 250



Lives impacted – 250

MAKING A DIFFERENCE

GW Safety & Sustainability

- Influence pathogen safe construction - 1 well for 250
- Influence well sustainability – assume 2 generations

Lives impacted – 500

MAKING A DIFFERENCE

GW Safety & Sustainability

- Influence pathogen safe construction - 1 well for 250
- Influence well sustainability – assume 2 generations
- Teach others to properly construct wells
 - Local driller – 500 wells or more likely over career

Lives impacted – 125,000

MAKING A DIFFERENCE

GW Safety & Sustainability

- Influence pathogen safe construction - 1 well for 250
- Influence well sustainability – assume 2 generations
- Teach others to properly construct wells
 - Local driller – 500 wells or more likely over career
 - Each add'l driller(s) – assume 1 add'l

Lives impacted – 250,000

MAKING A DIFFERENCE

GW Safety & Sustainability

- Influence pathogen safe construction - 1 well for 250
- Influence well sustainability – assume 2 generations
- Teach others to properly construct wells
 - Local driller – 500 wells or more likely over career
 - Each add'l driller(s) – assume 1 add'l
 - Your chapter; your professional career – assume 1 add'l

Lives impacted – 500,000

MAKING A DIFFERENCE

GW Safety & Sustainability

- Influence pathogen safe construction - 1 well for 250
- Influence well sustainability – assume 2 generations
- Teach others to properly construct wells
 - Local driller – 500 wells or more likely over career
 - Each add'l driller(s) – assume 1 add'l
 - Your chapter; your professional career – assume 1 add'l
 - NGO's, Funding agencies, Governments – assume 1

Lives impacted – 1,000,000 or more

MAKING A DIFFERENCE

GW Safety & Sustainability

- Influence pathogen safe construction - 1 well for 250
- Influence well sustainability – assume 2 generations
- Teach others to properly construct wells
 - Local driller – 500 wells or more likely over career
 - Each add'l driller(s) – assume 1 add'l
 - Your chapter; your professional career – assume 1 add'l
 - NGO's, Funding agencies, Governments – assume 1
- Resource protection – many generations



Lives impacted – INCALCULABLE

MZUZU, MALAWI

- NGWREF's first DN E&T grant
- Two courses over a week
 - 3 day – Drillers (incl. interpreter)
 - 2 day – NGO's, Government & Students
- Partner – SMART Centre, Mzuzu U
- Malawi Minister of Water – opening/closing remarks

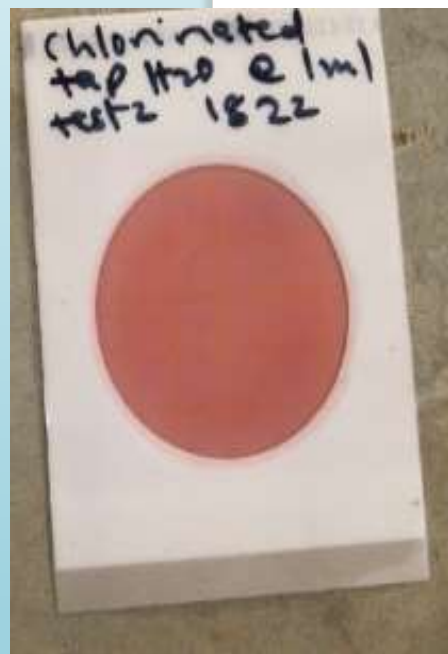
CUSTOMIZED PROGRAM

- **Diversified Format**
 - Course Txt – WATER SUPPLY WELL GUIDELINES...
 - PPTX, Whiteboard - w/discussions
 - Classroom demos (drill fluid, chips, sampling, sand tank)
 - Field demonstration
- **Diversified Presenters**
 - MU Water Dept professionals
 - Drillers (field demos)
 - NGWREF RG
 - NGWREF MGWC



VISUAL LEARNING

Petrifilm results



CUSTOMIZED CONTENT

- Components
- CBA
- Groundwater Flow
- Safety
- Ethics
- Contracts
- Opportunities (distributors)
- Regulations



RESPONSE from Malawi



Just a note to thank you for a wonderful program here in Mzuzu last week. Both the ...programs exceeded our expectations, and have challenged us to do a better job for safe and sustainable well construction. But, also to not just accept the status quo.

IMPACT – Estimates (since 2011)

Individuals incorporating all/part of proper well construction, or teaching it to others >60

Wells impacted (first year) >6,000

Individuals impacted (first year) >1,500,000

Add'l individuals impacted >3,000,000



MAKE AN IMPACT!

Thank You

steve@schneiderwater.com

www.schneiderwater.com

click on 'Hydrophilanthropy'

click on image of front cover:

