

)XWXUH FLW\ FKDOOHQJHLWDLQ RRSUS ZDWHU V VXVWDLQDEOH FLWLHV LQ ,QGLD

Vandana Pusalkar Vimala Swamy and Anand Shivapur

9LVYHVYDUD\ 7HFKQRORJLFDO 8QLYHUVLW\ %HOJDYL .DUQDWDND ,
5HYD 8QLYHUVLW\ %DQJORUH .DUQDWDND ,QGLD
9LVYHVYDUD\ 7HFKQRORJLFDO 8QLYHUVLW\ %HODJDYL .DUQDWDND

\$EVWUDFSLG XUEDQLJDWLRQ GHSHOHWHG UHVRROHVF IFREODDQFH LQ
WUHPHQGRXV SUHVXUH RQ HFRORJLFDODXWFKWHRQYLUKQPKQLMQLLV WQK
VFHQDULR LQ DOPRVV DOO ,QGLDQEDLQDHWYDND D\WHU IUDHWR 8HSHOH VQ QW KZK X
GHPDQG IRU WKH VDPH LV IDVW JURZLQZDWRIZ RRUHVR XWFDHQ H\YFH W KURHWH
IURP FOLPDWH FKDQJH SRXODWLRQHFORZWKJ D H\G\Q X E WU DDQVU DFWDULH W
RWKHU ORFDOLJHG FKDOOHQJHV 7KHOFKXO W\HQQH ELOH WRR FLDG CHFR DWRWLF
HFRQRPLFDOO\ YLDEOH FXOWXUDOODQV D\WIDJHLELDO DQGR WDFWK R R RZKLE
DUH DSSURSULDWH WR PHHW WKH QHHGXW W D WQDE OHW XUEJH GHVW D W B B M Q
:KDW LV VXVWDLQDEOH GHYHORSPHQWHYHWR B B QWW X B D RV M X S W D L D D E V
UHODWHG WR ZDWHU YDULRXV UHFHDM RW HSGW R IRF LZRUU GSYHORSPZDWH
SHUVSHFWLYH OLNH :DWHU VHQVLWLYH WFLW\ VXD\WHDUL QD E GHF EWRP XQV WU F
SURYH WR EH DQ LGHDO PRGH RI FLOW\ V X W H D Q R S E H Q W Z W W K D W X D O O R E X V Y
HFRORJLFDODDQDQFH VR WKDW VRFDDO D Q D Q H E R D F F K L H D Y H G X V W D L Q D E L O
.H\ZRUGV 6XVWDLQDEOH GHYHORSPHQW ZDWHU\H VFHQWLWLYZHDAW WU Z
VXVWDLQDEOH FRPPXQLW\

,QWURGXFWRQ

ZDWHU TXDOLW\ ERWK IRU SRWDEOH D
JHQHUDOO\ DFFRPSOLVKHG E\ UHPRYLQ
&LWLHV KDYH PXOWLSOLHG DQG HHS D Q Q H G J U P S L S O G Z R U W Q Z L S H S H +LV
RYHU WKH SDVW WZR FHQWXULHVP XQLEDS FOH QW ZHU VDKIDYDQG ZRUDLQDWH V
HFRQRPLF DFWLYLWLHV XWLOLJH P D P D L P X Z R Q S X W S R D V U H V R X E D H F K H D O
DQG JHQHUDWH PRVW ZDVWH DQ GUSHYHQXWURR RGL QJFH DQFH H R W W K H
WLPHV FLWLHV VWDUWHG DV ZDWHU H G O M Q D D J H W R K H D W W H O H P W L R Q V R R Q
WKH EDQN RI ULYHUV VWUHPV :LWKRXW ZDWHU OLIH LQ WKH FLWLHV
FRXOG QRW EH VXVWDLQHG :DWHU DQVR SURYLGHV IRU FOHDQLQJ
DQG K\JLHQH WUDQVSRUWDWLRQ O H W K R G R O R J L U L L J D W L R Q R I F U R S V D Q G
JDUGHQV GHIHQVH DQG WUDQVSRUWDWLRQ %XW ZKDW LV WKH
XUEDQ ZDWHU VFHQDULR DOO RYHU WUKHY ZRZU O S S ' S H U S H L F L D W O F O \ V W Q G \ W
GHYHORSLQJ FRXQWULHV OLNH , Q G E D Q L D D V L Q R L D D O P R R W K H O U H F R Y Q R U L F
IORZLQJ WKURXJK WKH FLWLHV RDU H O R Z H V W L Z D W B B C E R X G L H G I D Q G Q G L D Q
FRQYHUWHG WR GUDLQDJH FDU Z D W H U F R U F H I Q R U L R I F D Q C E H O W D K D Q V I R U I
SROOXWHG ZDWHU VWUHP VXVWDLQDEOH FLWLHV" ,Q ILUVV SDUW
\$V VWDWHG E\ DOPRVV DOO SDRNHV R X R Q D O W X G L N H X X D I E G Q Q J Q X P E H
SODQQHUV XUEDQ GHVLJQHUVH D O V R O V E B I S H Q G M K L V Q H W X V W D L Q D E O
HQYLURPHQW HQJLQHUV DQG XAFEDQ WILYWU VMLKD W\ XQREDFG Z D W G U L Q V
LQIUDVWUXFWXUH LWV SODQQLQJ D D G V W X G D H N P K I D W H C E H H Q V G R R H E W R V Y
FKDQJHG GUDVWLFDOO\ 7KH FRUFGS ZLXGH WRGUH V W H P S H O R W K B G H J U D G
LQ PRVW FLWLHV KDYH QRW FKDQJH B E F O X F K L M G R P S R P D D Q G L P X O W L I D F H W I
7KH\ FRPSULVH UDSLQ FRQYH\ DQFH SLSHG ZDWHU WR FDUU\
DZD\ KXP D Q D Q G L Q G X V W U L D O Z D V W H V I R U G L V S R V D O O D Q D J L Q J

&KDOOHQJHV LQ ZDWHU VHFWRU

&RUURVSRQGLDQJSDUWV XVDONDU#JPDLO FRP

8QSUHFHGHQWHG XUEDQLJDWLRQKDDQGIHFWGXEWODDQDQYDMLBRSOH D
LPSRVLQJ HQYLURQPHQWDO GHJUDGDWLRQ RQ VXFK D YD VW VFDOH
WKDW UHVXOWV LQWR SROOXWHG ZDWWURERGRMDQDQYGHODLEOLHVLSWWW
H[WUHPH SUHVXUHV RQ XUEDQ ORFDZDERGLHV WGRBNBQDQYDLODIEOHK Z
DQG PDQDJH VDIH DQG FOHDQ ZDWDHSHGXSGOQDWRLHJWRZLQJ JURXQG ZD
SRSXODWLRQ 7KH FKDOOHQJHZDWWR VXSS(QWHDQDQYDMLXZDWRIU ZDWHU
SHU & 3 & % &HQWUDO 3ROOXVSLXUSRHWQWQIRCH %GRPHQWLGDDULFXOWX
VWDQGDUGV WR HDFK DQG HYHURWLRQZDWHGXVDDDFLSHU WKHMU LQHSIGVVLV
E\ NHSLQJ LQ PLQG HFRORJLFDRI VORZDQDDELOHVV DWUDHPPDLQRU VWD
FRQFHUQ ERGLHV DV YDULRXV SROOXWDQWV PL[H
SURIHVLRQDOV WKLQN WKDW ZDWHU U
UHGXFH WKLV ZDWHU VFDUFLW 'HJUD
UHVXOW RI LPSDFW RI VRFLR HFRQRPLF
LV D TXDOLW\ SUREOHP UDWKHU WKDQ

7KH ZRUOG ZDWHU FRXQFLO VDIHQVWKLXWLRQDOZDWHUHQVWLQZDW
WRGD\ %XW WKH FULVLV LV QRWZDWHXWKSHEWJWRKXUFLDQZDWHU
VDWLVI\ RXU QHHGV ,W LV D FULVLV RI SRRU ZDWHU PDQDJHPHQW

7DEOHQVWLWXWLRQDO FKDOOHQJHV DQG RSSRUWXQLWLHV LQ ZDWHU

6U 1R,QVWLWXWLRQDO FKDOOHQJHV DQG RSSRUWXQLWLHV	
3ODQQLQJ DQG FRORJLQDQJWLRQ QRW FR RUGLQDWHG YHR LQWHU LQQLWLDWLYHV ULJKW IURP FHQWUPLDOROHVHQRQR DQG ODFXQDV LQ LPSOLPHQWDWLRQ RI LW LQ IOH	
)LQDQFH PDQDJHFRORJLQDQJWLRQ LQQRWDWLYH ILQDQFLDORVWLDQVHQRVORV FHQWUDOLVHG DSSURDFK ,QHILFLHQW WR PDQDJH	
\$FWV E\H ODZVN\UXGHHVHUVQRZRZ RUJDQLJDWLRQDQJHURNDQWR UHJXODWLRQV LPSOHPHQW SURMHFWV	
&RPPXQLW\ SDUWLQJSDUWLQJFRORJLQDQJWLRQSDUWLFLSDWLRQDQJHURNDQWR LQVLSDWLRQ	
&XOWXUH .QRZOHQRZDQDDELOHVVWKDQJHV QHHGHG ZDWHU DSSURSULD PDQDJHPHQW LV FKDOOHQJLQJ DQG UHVXOWV FDO	

SDUNV XUEDQ IRUHVWV FHPHWHULHV
\DUGV FDPXV DUHDV ODQGILOOV DQ
VWUHDV ODNHV SRQGV DUWLILFLDO
+RZ FOLPDWH FKDQJH DIIHFWV ELHWLQWLRQ SRQGV'

2Q RQH VLGH FLWLHV DUH SODQDQJ Urban Water and Human health for cities
GHHORSRPHQW EXW LQ GXH FRORJLQDQJWLRQ WKH RWKHU VLGH
KXPDQ ZHO EHLQJ LQ FLWLHV LV YHU\ QHOHFWHG SDUW 1RZ
FOLPDWH FKDQJH ZLOO KDYH GLUHFW LQFLWLYH DQDQYDMLVWLRQDQJHURNDQWR
WKHVH UROHV 7KH GLUHFH LPSDFWV LQFLWLYH DQDQYDMLVWLRQDQJHURNDQWR
VXGGHQ VKRFNV OLNH VWRUPV PDQDJHSDUWLFLSDWLRQDQJHURNDQWR
IORRGV RU JUDGXDO LPSDFW VWRUPV LQFLWLYH DQDQYDMLVWLRQDQJHURNDQWR
WHPSHUDWXUH LQFUHDVH DQG ZDWHUFRORJLQDQJHURNDQWR WKH +HDOWK\ &
RULJLQDWHG LQ 7RURQRW &DQDQJHURNDQWR
FLWLJHQV ZDWHU KHDOWK SODV PDMR
DQG DJUHHG E\ :+2 :ROG +HDOWK 2U
KHQRH SHURRWHG KHDOWK FLWLHV
VLOFH

2.2.1 Resilience and Urban Ecosystem services

7KH FDSDFLW\ RI ZDWHU V\WHP WR VXVWDLQDQJHURNDQWR WKH
DGYHUVH HIIHFWV DQG UHWDLQ LWV EDVLF LGHQWLW\ IXQFWLRQ DQG
SHUIRUPDQFH LV FDOOHG UHVLOLHQFH 6DPH FDQ EH WUXH WR
WKH FRQWH[W RI FLWLHV 7KH FDSDFLW\ RI FLWLHV WR VXVWDLQ DQG
DGRSW WR WKH DQDQYDMLVWLRQDQJHURNDQWR
HFRORJLFDQ FULVLV ZDWHU FULVLV DQG FOLPDWH FKDQJH JOREDO
ZDUPLQJ HWF DQG VWLOO WU\ WR UHWDLQ LWV EDVLF LGHQWLW\
IXQFWLRQ DQG SHUIRUPDQFH LV FDOOHG SHULQH LGHQWLW\ FRPLF GHHORS
3UEDQ HFRV\WHP VHUYLFHV ZDWHU V\WHPV DQG LQWLRQJ PRUH DQ
GLYHUVH VHW RI KDELWDWV LQFUHDVH JUDWLQJ VSDWLFLVWLRQ

ZKDWHYHU DFWLRQV WDNHQ DJDLQVW QDWXUH DW ORFDO OHYHO KDV
GLUHFWO\ RU LQGLUHFWO\ DGYHUVH \$ HMVWVWV VVWDLQDEOH GYHORSPHQW
JORED OYHO 7R DVVHV VVWDLQDEOH GYHORSPHQW
JRDOV UHODWHG WR ZDWHU QHHGV NORZOHGJH RI XUEDO
+\GURORJLFD O\FOH DQG KRZYLVVWV DDEDDDFHUEDD ZDWHU YLVLRQ
UHSHUFVVLRQV ERWK DW ORFDOYLVLRQ\HQDEOH\HVSORSH WR ZRUN WR
DQG DFURVV GLVFLSOLQHV ,W HQDEOH
WR LQYHVV LQ ORQJ WHUP PHDVXUHV
EH\RQG SROLWLFDO F\FOHV 7KH ,Q
\$VVRFLDWLRQ SXEOLVKHG ILQDO GUDIV
ZLVH FLWLHV ,Q WKLV GRFXPHQW WK
GHFLVLYH UROH LQ PDNLQJ LW SRVVLE
(IIRUWV WR PHHW KXPDQ ZDWHUYLVLRQV RI W\XVWV DQDDEODHUV EDD ZDWHU
FDXVH QHJDWLYH HQYLURQPHQWDO LPSDFW DQG VWUHVV RQ WKH
ZDWHU \V\WHP DW UHJLRQO DQG JORED VFDQV +HQFH
DVVHVVLQJ 6XVWDLQDEOH 'HYHORSPHQW *BDQV\WLVH WDU\HWLVHV
UHTXLHV EURDG DQG LQ GHSWK NORZOHGJH RI WKH JORED OYHO WR
ORFDO GQDPLFV RI ZDWHU DYDLODELWLW\ DQG XVH
6XSHULPSRVLQJ WKH GLIIHUHQW <HDUPHQWV EHQHURFZDUG ODXQFK
FKDQJH WKH TXHVWLRQ WKXV D\PRV\HPHQWRZQV XVW ELPDNE QHDKXPHQ &LW
GHYHORSPHQW FDQ EH HQVXUHGZKKEKHKH\GHHVXDUJLQKHZD\WV FDQ
YLWDO OLIH VXSSRUW \V\WHP RQRZHQFKSWKHVZ\MO\DUHQRIZEXUKRQXUH
DQG IXWXUH JHQHUDWLRQ GHSHQGV \$V &V\WVHG VLQXWKPHYLULQVUHDV
VHQWHQFH RI WKH :RUOG :DWHU IRYMORSPHQW 5MSRQWILQLWLRQ ZDV F
3DWHU LV DW WKH FRUH RI VXVWDLQDEOHVGH\HQDEODSPHQW DQGHVFLW
ODWWHU LV VWURQJO\FRQQHFWEHQVRGHHJHW\BDBELQQLWLRQVHQDGHVDOV
WR VXIILFLHQW TXDQWLW\ DQG STRSOLHVGHEALZDWHG WRUPMQLPLJDWLRQ
SUHVHUYDWLRQ RI KHDOWK\ HFR\QHW\HPVZD\GULVQLLQEGDQJRUZDVWH
VRFRL HFRQRPLF DQG KXPDQ SRIDQ\WLSPHQW&2 PHWQDQH DQG ZDW
6XVWDLQDEOH 'HYHORSPHQW *ZDUPHQ* FGLPDDQGH FKDQJH DQG RW
6' * DUH IXOO\ HPSDVLVHG RQ H\KW\WU\QDEH H\XURD QZD\WUJ JURZWK
PDQDJHPHQW IRU UHVLOLHQW FLWLXWULHV W\RD SKLRPHVW KLFZFLWLHV D
QHHG WR KDUQHVV WKH SRZHUGHHYHORSODXVWDLQDEOH ZDWHU FHQW
SDUDGLJP IRU ZDWHU PDQDJHPHQW JHQHW\W\XFWXLQW VWQDWHJLVH
SROLFLHV HQDEOHG E\ QHZ JRY\HQRQ\HGWKDSMUV\XDFHEQRDGHU
FROODERUDWLRQ PRWLYDWHV VWDNHHKROGHU HQJDJHPHQW DQG
DFWL\H FLWLJHQV KLS LQYROYHPHQW DV VKRZQ LQ WDEOH

7DEORKH IRXU OHYHO RI DFWLRQ

Table with multiple rows and columns containing alphanumeric characters and symbols, likely representing data from a specific study or conference proceedings.

H[SORLWDWLRQ RI ZDWHU UHVRXUFHV
 DV ZDWHU LV OLIH ZLWKRXX ZKLFK VX
 6PDUW FLWLHV \$ YLVLRQ IRU GHYHORS
 ZDWHU SHUVSHFWLYH ,QGLD
 ,Q XUEDQ ,QGLD 8UEDQ ZDWHU PD
 VLJQILFDQW FKDOOHQJH LQ IURQW RI
 3&LWLHV LQ WKH SDVW ZHUH EXLW
 EXLOW DORQJ KLJKZD\ %XW LQ WKH
 EDVHG RQ DYDLODELOLW\ RI RSWL
 JHQHUDWLRQ LQIUDVWUXFWXUH
 7KH QXPEHU RI 6PDUW &LWLHV
 E\ *RYW RI ,QGLD LV WR PDNH FLW
 6PDUW &LWLHV HYHU\ FLWL]HQ
 ZLWK DOO EDVLF DPHQLWLHV DQG
 DQG HQYLURQPHQWDO VXVWDLQDELOLW\ LV WKH PDLQ DJHQGD RI
 GHYHORSPHQW 7KH FRQFHSW RI VPDUW FLW\ YDULHV IURP
 RQH SODFH WR DQRWKHU ,W GHSHQV RQ WKH OHYHO RI
 GHYHORSPHQW ZLOOLQJHVV WR FKDQJH DQG ZHUHUP
 UHVRXUFHV DQG DVSLUDWLRQV RI WKH FLW\ UHVLGHQV 7KH VPDUW
 FLW\ VKRXOG SURYLGH D FOHDQ DQG VXVWDLQDEOH GHYHORSPHQW
 FRQVLGHULQJ WKH DVSHFWV RI WKH FLW\ UHVLGHQV DQG WUHDWLQJ
 HQYLURQPHQWDO VXVWDLQDELOLW\ WRUP ZDWHU JURXQG ZDWHU DQG Z
 \$ VPDUW FLW\ VKRXOG EH DEOH WR SURYLGH XWVHG ZDWHU ERGLH
 4XDOLW\ RI /LIH WR LWV FLWL]HQV LQ WKH FLW\ UHVLGHQV DQG
 VHFUXLW\ IRU ZRPHQ FKLOGUHQ DQG DGGDWKRUVK QGLD 3DQFKJDDJ
 LQFOXVLYHQHV HQWHUWDLQPHQW DPHQV WR SXEOLF DQG RWKHU UL
 FRVW HILFLHQW KHDOWKFDUH TXDOLW\ XSDWLQV DQG ZDWHU FLV
 DFFRXQWDELOLW\ DQG RSSRUWXODLW\ SHUW&L \$ %RSHUWUDO
 JRYHUQDQFH %RDUG ,QGLD 7KLV 7KH UHFHQW
 VXVWDLQDEOH XUEDQ ZDWHU PDQDJHP
 OLNH UDLQZDWHU VWRUP ZDWHU JUR
 VXSSRUWV WKH LPSRUWDQFH RI ULYHU
 ULYHUV DUH WKH OLIHOLQHV RI FLWLH
 OHYHO JUHQ LQIUDVWUXFWXUH OLQN
 VKHG PDQDJHPHQW WR EDODQFH XUED
 ,Q ,QWHUQDWLRQDO :DWHU 7R DQDJHPHQW VXVWDLQDEOH XUEDQ ZDV
 SXEOLVKHG RQH VXUYH\ RI SURMHFWV ZDWHU UHVLGHQV XUEDQ ZDV
 ZRUOGZLGH ZKLFK VD\ PRUH WKDO ,QGLD SODQQLQJ WRROV DQG L
 ZDWHU VFDUFH DV WKH SRSXODWLRQ LPSOLQHG LQ WKH 1R PLOOLRQ
 WRGD\ ZDWHU DYDLODEOH IRU ZRUOGIV
 SRSXODWLRQ 8QDYDLODELOLW\ RI ZDWHU RYHUXVH DQG
 ,QGLDQ ZDWHU VFHQDULR
 ,Q ,QWHUQDWLRQDO :DWHU 7R DQDJHPHQW VXVWDLQDEOH XUEDQ ZDV
 SXEOLVKHG RQH VXUYH\ RI SURMHFWV ZDWHU UHVLGHQV XUEDQ ZDV
 ZRUOGZLGH ZKLFK VD\ PRUH WKDO ,QGLD SODQQLQJ WRROV DQG L
 ZDWHU VFDUFH DV WKH SRSXODWLRQ LPSOLQHG LQ WKH 1R PLOOLRQ
 WRGD\ ZDWHU DYDLODEOH IRU ZRUOGIV
 SRSXODWLRQ 8QDYDLODELOLW\ RI ZDWHU RYHUXVH DQG

7DEOH 1. YH EXLOGLQJ EORFNV WR GHOLYHU VXVWDLQDEOH XUEDQ

9LVLRQ	*RYHUQDQFH	.QRZOHGJH & DSDFLW	DHWLRQ	DODQQLQJ
5HVLOLHQW HQDEOHV ZRUN WRJ JUHDWHU XUEDQ FRPP	FLW\ UHVLGHQV SHUVSHFWLYH HMHUUDIR EXUEHQWV XQFLZRUN WR	FRQJEDQG VWD RQYH SNRZOH LDSDFLWLV DFHROGZILWK	\$VWKRWGPD PHVHDQG DHFGLRQ VWVWVWV DFWLRQ	EDVHG DVRXUDQF QF\ HOLW\ DQ
\$ VKDUHG LPSOHPHQW QHZ SROLFL	,QWHUQDWLRQ DHWLRQFLWRIV GHVVLJQ	7K LPSXUH ZDWHU VYDQ GRQG FR	XGWDQDEOH DQDEOH HQRISWV SURMHFWV VROXWLRQV	WRROV H HILFLH RQV
\$ VXVWDLQ ZDWHU YLVL	DECFHQXVLE RQV DNHKRO	DQV XRWXUE G VXFVHVHV	HG XUELOLQZ VHUFLH	PHFKDQLVPV
,W FRQVLVWHQ SROLWLFDO	RQGLQV LQJ FEHQHURQV FLW\ UHVL	7KWKHDELOLW RUHZRKHU HW R	WHQWKRJCS RQVWVWVWV RZLGHV FIFOH	SHG VHUYL LQYHVWPHQV

,W LV DOVR YHU\ RIWHQ HFRQRP\WVDFDOP YLIDHE OFK DYOHHQ XQJG IPD\ UHVHP
SUHYDLOLQJ HFRQRP\ PRGHOV \B XRYRGRHVKWIKXJKRAXKH FXGLVLSQBHUHVS
VHUYLFHV DQG DOO WKHLU DVVRFLIDWXHUGVEHSCROLWVFR UL QVWHLWDXWLRQD
QXPEHU RI EHQHILFLDULHV LQ FLWLHV ULYH USU BSHUOLIFQDQMLIRHWKH F
DQG UHFRJQLJHG 6XFK LQIRUPDWKRWDLVQBEOHQZDLDVHOU WFRHQV BOKGFR FL
LQ GHFLVLRQ PDNLQJ SURFHVVHV RHOHOBWZDWWBFBOGGWKRQ DQGLGH WK
PDQDJHPHQW LQ XUEDQ ODQGVFDUHV RQQRQRHSMOSVJGHSKQGLDQXSRQ
DQG ODQGVFDUHV SODQQHUV ZDWHKLWFRFOWV 7KHVZVWRWBZDWGU JUD\
SUDFWLWLRQHUV DQG SXEOLF SRODQJPHQWUW DQG ZIROQDZDSUWLM DVWHDJ
DQG LQVWLWXWLRQDO VWDNHKROPHUW SDUWV RI FLW\ IXQFWLRQLQJ DQG

5LVHU\ HFRORJLFDO KHDOWK :K
GHYHORSPhW SDUDGLJP IRUP FLWLHV
YLHZ LW LV LPSRUWDQW WR ILOO WKH

5HVXOWV DQG UHFRPPHQG DWLHQW EDQ GHVLJQ XUEDQ SODQQLQJ
8UEDQ QH[XV RI ZDWHU ± IRRG ± HQUJ

XSRQ ZKDW NLOG RI KXPDO DQG QD
\$OZD\ WKHUH DUH WHQVLRQV SHUWZHQW SUHWHUYLWLRQ DOG 5HFHQW
PDQDJHPHQW QDWXUH DQG FXOWXUH WUDGLWLRQ DQG
WHFKQRORJ\ WKHRU\ DQG SUDFWLFH 3URROJHG DQG
LPPHGLDW HIIHFWR SRSXODU RYLRGLDQJ DQG PHQWGO FKDOOHQJHV
XQSUFHGHQWHG XUEDQLDWRQ GHVLYLBRUPZHWYDQZBW WFRHV
QHZ FKDOOHQJHV WR SURYLGH DOO EDVLF LQIUDVWUXFWXUH VHUYLFHV
DQG WR FRQQHFW WKHP DW FLW\ OHYHO EDVLF SODQQLQJ
PDQDJHPHQW LPSOHPHQWDWRQ DQG PRQLWRULQJ RI DOO ZDWHU

7DEOH 6 XVWDLQDEOH ZDWHU FHWLHV

:DWHU	7KH IRFXV RI VXVWDLQDEOH FLWLHV PRYHPPHQW
0LFUR VFDUH	*UHHQ EXLOGLQJV
6XEGLYLVLRQ	(FR EORFNV
0DFUR VFDUH	(FR FLWLHV DQG HFRQRPV FDOO\ HQLLQHUUHG XUEDQ ZD
8UEDQ HFR	5HJLRQ FRQFHSW 6XVWDLQDEOH XUEDQ ZDWHU F\FOH
:DVWH ZDWHU	WVHG ZDWHU SURYLGHV HQUJ\ LQ WKH HFRORJLH WUWLB DW AP UH XVH DQG KHDW 8VHG ZDWHU 5HFODLPHG ZDWHU 5HVXUF
K\EULG	3DUWLDQO\ GHFHQWUDO UJPH ZDWHU XQOHG ZDWHU WUWLB ZD

VWUDWHJLHV DOVR SURPRWHV VRFLD
HFRQRP\ DORQJ ZLWK HFRORJLFDO UHV

&RQFOXVLRQ 7KLV UHVHDFK ZDV VXSSRUWHG
7HFQQRORJLFDO 8QLYHUVLW\ -QDQD 6D
IRU *UDQW RI ILQDQFLDO DVVLVW

*HRJUDSKHU 0DWWKHZ *DQG\ ZULWHV ± 3:DWHU LV QRW
VLPSO\ PDWHULDO HOHPPHQW LQ WKH SURGXFWLRQ RI FLWLHV EXW LV
DOVR D FULWFLDO GLPHQVLRQ LQ WKH VRFLDO SURGXFWLRQ RI
VSDFH 5HIHUUHQFHV

7KH FDOOV IRU 3:DWHU FHQWULF VXVWDLQDEOH
FRPPXLWLHV 3&LWLHV RI WKH)XWXUH 3QVW DKA DELOHDG HXQYLURQPH
JHHQ XUEDQLV\ PD\ VRXQG WR ZRUOERIB of the World Health Organization
GUHDPV WKDQ D SRWHQWLDO UHOLW\ %XW WKH IXWXUH LV
DOZD\ DQ H\WHQVLRQ RI KLVWRU\ DQG 1 RWQRHQTRICJFHG DQG
JXLGHG E\ QHZ LQFUHPPHQWDO G\SSPHUFDLHV 2 DQG, /V WUWLB VVH, 1&R, 6% 1
VROYH PXOWL DVSHFW SUREOHP PXOWL G\OFRVSKOLQDQ\ UDWKHU
WUDQV GLVFLSOLQDU\ UHVHDFK 6%V DEVROXWH QHIVVDU\
7KH WLPH KDV FRPH WR ORRN IRU 9 DQG YRQORJLH WUWLB
FRQFHSWV IRU XUEDQ SODQQLQJ DQDQW WFRVH\ IRHUGL JQ8 Q QY WUWLB
3&LWLHV RI WKH)XWXUH\ FRQWHVXU QW DEDW WRU DVRRNS VRQ 6DQV
OHDUQ IURP WKH SDVW DERXW WFRVH\ SRQDQFHG IRU WZLQVWU LQ
FLWLHV 5HVLOLHQW FLWLHV DQDQW WR SUGESTED JNDICQES Ofor WUWLB
FRQVHTXHQFHV DQG LOO HIIHFWR MonRitng B S L B WUWLB DQLDWRQ DQG
LQGXVWULDOLJ DWRQ DOVR EULQJ CQNSQDQD ZHQRS SRU WUWLB
IURQW RI IXWXUH XUEDQ SODQQHUV :DWHU VHQLWLWYH
VXVWDLQDEOH FLWLHV EDVHG RQ ORZ LPSDFW GHYHORSPhW

(5LHW Improving health in cities through
systems 0 D Q F K H V W Q U L U R Q P H D O W D K O

Principles for urban stakeholders to develop a shared
vision and act towards sustainable urban water in
resilient and liveable cities 7 K H , : \$

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Adapting to climate change in R Q G R Q 8 . + X P D Q

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&) Resilience: the emergence of a perspective
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The united nations world water development report:
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Principles for urban stakeholders to develop a shared
vision and act towards sustainable urban water in
resilient and liveable cities 7 + (, : \$

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built components of urban mosaics: an open cycle of
ecological design." - R X U Q D O R I (F R O R S S 9 R O

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9 8 S D G K \ D \ S m a r t C i t i e s : A V i s i o n f o r

Development of Indian Cities, P S H U L D O - R X U Q D O R I

, Q W H U G L V F L S O L Q D U \ 5 H 6 H D U F K , - , 5 9 R O

Water scarcity. 6 O , Q W H U Q D W L R Q D O Z D W H U P D Q D J H P H Q W

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sustainability, : D V K L Q J W R Q ' & 1 D W L R Q D O \$ F D G H P L H V

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