

7KH URΘ RI WDM LQMMXMRQV RI . \ UJ \] WQ LQ WKH IRUP DMRQ RI Z DMU UHVRXUFHV P DQDJ HP HQMSRQF

0 XNKDUEHN 0 LVURMFK 0 DGDHY \$VH %LQRYD %LQRYD 1 XJDW 0 XNDPEHRYD
1 DP DPHRYD 1 XUDQ\$NPEHRYMFK 1 XUDHY \$VH\$P DQNDQN \ \$ QP

, Q W H U G B D W Y R R I D Q W J V W D U \] 5 H S X P Q L L F K N H N

\$EWDFW7 K LDU WHL [FSOHRVUKHPVS R U W D V O F F W L R U W Y H V Q P H Q W
D J H Q F L Q W K B H Y H O R S R I G P W O H P H Q R W Z D W L R I Q V R X U F H V
P D Q D J H P W Q D \$ E D I C H M Q B Q F W L Q S R Z H U J R Y H U Q P H Q W
L Q V W L W X O K L V R I G B V F X K W Q U O X R O V R I H U P D R M Q R Q L V O D W L R Q
W I G H Y H O R S Z F H W Q H U V R R D Q H V H P M W D N V O F L Q H L W W R K I H Q U
L P S O H P H Q W I D W W B E G I R D P L Q X I U S H Q R V E O H F K D O O H Q J H V
I D F I E G R Y H U Q R H V Q W L M Q W L U R H O D I G O V R J J Z D W W R R O Y H
W K H P I R I Q V X I X N W D E Q Q B O H I R I Z Q W U H U V R X L Q F H J V J V W D Q
3 D U W I D F X O E L O S V D L R Q K U R B I H R Y H U Q R H V Q W L M Q W L X R O D W L Q J
D F F H W E Z D W H H V R X D V Z H H V D O L G G H Y H O R S I U O J W H R I U V X U H
V X V W D X Q B I Z O M U H U V R X L O F F K D Q J L O L P Z K W H H V R O W K V H
V W X P G I E H X V H I I X R O R U P L Q H F R P P H Q G R O U P I S R J R V Z D O W H U
U H V R R D Q H V H S P H O L M F Q H J V J V W D Q
. H \ Z R U G W \] V W J R Q Y H U Q R H V Q W W X W W H H B Q R P D Q H V H P H Q W
H F R O I R Q V W L W X F K L R Q R I D V Q D J H S P U F C E V S H U R W S H F W V

, Q W U R G X F W L R Q

: DMU UHVRXUFH P DQDJ HP HQMSRQV D NH DSHFWRI HQXUQJ VXDQDCEH GYHDSP HQV DGG
HQVURQP HQMDV HW LQ P DQ FRXQNHV LQFOXGJ . \ UJ \] WQ ' XHVR WHXQJTXHJR UDSK LFO
QFDNRQ DGG FOP DM FKDFMUMFV WH Z DMU UHVRXUFH RI RXU FRXQV SD D SDUFXQD
LP SRUDQURD LQ VSSRUWQJ WH QYHQRRG/ DGG GYHDSP HQVRI LWSRSDI + RZ HYHU HIFWYH
P DQDJ HP HQVRI WH H UHVRXUFH UHTXUH V R X G S R Q F H / G Y H D S P G D G G I P S O P H Q M G E U H O Y D Q V
J R Y L Q P H Q V Q M M R Q V

7KHSXSRVHRI WMLV DUVFHLV R D Q D J H V H U R Θ R I W D M L Q M M X M R Q V L Q . \ U J \] W Q L Q V K S L Q
Z D M U U H V R X U F H V P D Q D J H P H Q V S R Q F H V 7 K U R X J K D F U M F D O U H L Z R I W H Q A I D M U H D O D V L V R I
Q U I L O M R Q D G G S R Q F W A D M U H V D V Z H O D V R Q W H E D M V R I R X U R Z Q U H H U J K L V V S D Q Q G V R
F R Q I G U K R Z J R Y L Q P H Q V D J H Q F H V L Q . \ U J \] W Q L Q M U F W D G G L Q Q H F H W H I R U P D M R Q D G G
I P S O P H Q M M R Q R I S R Q F H V L Q W H I I L Q R I Z D M U U H V R X U F H V P D Q D J H P H Q V

, Q W L V F R O M W H U R Θ R I W D M L Q M M X M R Q V L Q W H I R U P D M R Q D G G I P S O P H Q M M R Q R I Z D M U
U H V R X U F H V P D Q D J H P H Q V S R Q F H V L Q . \ U J \] W Q L V R I S D U F X O U L P S R U D F H \$ Q D O V L V R I W H
H I F W Y H Q H W R I J R Y L Q P H Q V D F W R Q / D G G W H L U P S D F V R Q W H G Y H D S P H Q V D G G I P S O P H Q M M R Q
R I Z D M U U H V R X U F H V P D Q D J H P H Q V W A D M U H V F D Q V K G Q K V R Q W H S U R S F W I R U V X D Q C E H
G Y H D S P H Q V R I W H F R X Q V L Q W L V D J D 7 K H Z R U N H J D P I Q W H P D Q D S F W R I Z D M U U H V R X U F H

& R U U H V S R X O V K I R Q U [K W D U E H N # P D L O U X](https://doi.org/10.1051/bioconf/202410704001)

P DDDJHP HQ/VQVHFRXQV DGG DOR DDDJ] H/VHFRQVEXVNRQRI JRYHQP HQ/VQVMMNRQ/VR VMLV SURFW VNLQ LQR DFRXQVFXUHQVFKDDQJHV DGG GYHBSPP HQVSRVSHFW 7KH SUHQVQNG DDDVLV FDQ VHYH DV D EDLV IRU GYHBSLQ UFRP P HQDNRQV VR LP SURYH VHHI LFLHFA RI Z DMU UHRXUHP P DDDJHP HQ/VQ. \U\] WQQ DGG VSSRUVWH VVWQDQDQ GYHBSPP HQVRI VHH UHJLQ

0 D W H U L O Q H W K R G V

7KLV VWG FRP ELQH TXDDMAYH DGG TXDDMAYH DDDVLV VR HJ SGRUH VHH URD RI JRYHQP HQV LQVMMNRQ/ LQ. \U\] WQQ LQ VDSLQ Z DMU P DDDJHP HQVSRFLHV & RGGXFWG GRFXP HQV DDDVLV VWG RI RI LFLDQ GRFXP HQV OZ V UHXDNRQV DGG VMDMLF GRFXP HQV UHDMQJ VR Z DMU UHRXUHP P DDDJHP HQ/VQ. \U\] WQQ 7KLV P HNRG DDBZ HG XV VR JDQ DQXCGH VMDQGLQ RI RI LFLDQJRYHQP HQV UHXDNRQV DGG VMDMLH/LQVMLV DUD \$ Q DDDVLV RI VHDVYUWH/RI VDM LQVMMNRQ/UHSRQLEOH IRUZ DMU UHRXUHP P DDDJHP HQ/VQ VHFRRXQV Z DV DLUHGRXW: HJ DP LQH VSFLIF FDV/UHQDNG VR Z DMU UHRXUHP P DDDJHP HQV VR JDQ D GHSU XCGH VMDQGLQ RI VHH SUREOP V DGG FKKDQJHV IDFG EA JRYHQP HQV LQVMMNRQ/

5 H V X O W V

,Q. \U\] WQQ VHHU DUD QP EHURI OZ V DGG UHXDNRQV JRYHQP HQV VHXV DGGP DDDJHP HQV RI Z DMU UHRXUHP , QSDVFXDU VHH/ DZ 3: DMU & RGHRI VHH. \U\] 5HSXDF GDMG-DQXU 1R VHH/ DZ RI VHH. \U\] 5HSXDF 32Q: DMU GDMG-DQXU 1R ;,, VHH/ DZ RI VHH. \U\] 5HSXDF 32 QXQDQV DWRFLDNRQ/ RI Z DMU XHV/DGGXQDQV RI Z DMU XHV/DWRFLDNRQ/ GDMG 0 DUFK 1R DGG DQX P EHURI OZ V DGG UHXDNRQV RI JRYHQP HQV ERGHV DSSURYHG LQ VHHU XCFNRQ/ Z KLFK HVDQK UKOV IRU VHXVRI Z DMU UHRXUHP VHH SURMNRQRI VHHUFRX VMP V DV Z HODV P HFKDQV P VIRUFROQRDGG VSHU VLRQ RI VHHU XH : VMLQ VHHI UDP HZ RUN RI VDM Z DMU UHRXUHP P DDDJHP HQV VHHU DUD YDUJRV ERGHV DGG LQVMMNRQ/ LQFOGLQ VHH: DMU 5HURXUHP/6HULFHRI VHHO LQVW RI \$ JUEXDMUH DGG/ DGG 5HODV DNRQRI VHH. \U\] 5HSXDF Z KLFK LV VHH P DQHQ HFXWYH ERG LQ VMLV DUD DV Z HODV VMD DGG OFDODXMRUWH/

' HSLM VHH HJ LVMDFH RI D QULVDMYHI UDP HZ RUN DGG LQVMMNRQ DOWKFXMUH VHHU DUD VMD SUREOP V LQ Z DMU UHRXUHP P DDDJHP HQ/VQ. \U\] WQQ 7KH VHSUREOP VLQFOGH LQH I LFLHQV XH RI UHRXUHP LQXII LFLHQVFRQNRQV HFKDQV P VIRUZ DMU SROXNRQ DGG FRQ OFWEH WZ H Q YDUJRV VDNKROHV ' HSLM DQX P EHURI FKKDQJHV P DGH DGG P HDXUHV VDNHQ VHHU DUD VMD DQX P EHURI SUREOP V VMD VDUH REVLYHG LQ VHHI LHQRI Z DMU P DDDJHP HQV @

2 QH RI VHH P DQ SUREOP V LV VHH OFN RI UHRXUHP DGG P HQV VR HIFVYH D FRQNRQZ DMU SUREOP V LQFOGLQ VHHU XH 7KH UDUHRI VMD FDVH RI XQDMRUJ HGZ DMUGLYH VLRQ HJ FTHGLQ VHHQP LVRI SHUP LVW GZ DMU XH DGG LQXII LFLHQV UHXDNRQRI Z DMU SROXNRQ

\$ GRM H U SUREOP LV VHH OFN RI FRRUGDNRQ EH WZ H Q VHH YDUJRV JRYHQP HQV LQVMMNRQ/ UHSRQLEOH IRU P DDDJLQ Z DMU LVXHV 7KLV FDQ QDQ VR GXSDFNRQ RI IXCFNRQV OFN RI ILQDQDQ WQQ SDUHQF DGG GLILFXQVH LQ SDQGLQ DGG LP SOP HQVQ Z DMU P DDDJHP HQV VMDMLH/

,Q DGG VLRQ VHHU LV D SUREOP RI LQXII LFLHQVSDUWFSNRQ RI VHH SXDF DGG OFDQ FRP P XQVH/LQ VHH SURFWRI P DDDJLQ Z DMU SUREOP V 7KLV FDQ QDQ VR LV XCGH VMDQGLQ VRI OFDQJH DNRQ KLSV DGG LQMUHW DV Z HODV FRQ OFWEH WZ H Q GLIHUHQ/SDUWH/

\$ QVHH H U SUREOP V UHTXUH V VMP LF LQMDVNRQ DGG VSSRUVRU VHHI IRUV RI JRYHQP HQV LQVMMNRQ/ OFDQFRP P XQVH LQGLYGDVDFVUJ DGG LQMDNRQ DORUJ DQJ DNRQ VR VROYH VHP ,P SURYLQ Z DMU UHRXUHP P DDDJHP HQ/VQ. \U\] WQQ LV RGHRI VHHNH SURUWH VR HQXUHVH FRXQV VIXMUHG YHBSPP HQV @

7KH LQFUDLQ LP SDFARI FOP DM FKKDQJHV DV DOR KDYLQ DP DMU LP SDFVRQZ DMU UHRXUHP P DDDJHP HQ/VQ. \U\] WQQ 7KLV LV UH OFVGLQ FKKDQJLQ UDQ DQSDVNLQV QZ HUZ DMU OYH VLRQ UYHV DGG QNHV DGG DQ LQFUDH LQ VHHI UHTXCF DGG LQMQWV RI QMDUDQGLVDMV VXF DV

GURXJKW DQG IORGV . \UJ] VDDQ EHU DQVR IDFHFKDQJHV/LQVMIH UHTX-HCF DQG FRXUJHRI HJ WHP H
IP SDFW VFK DV GURXJKW IORGV DQG FKDQJHV/LQ SUHFLSDVNRQ Z KLFK QHJDNYHD SHUJMLQ
FRQGLWRQ/R SUH-HCFH DQGZ DMUTXDDW > @

2 QH RI VMH P DQ SUREOP V FDXVHG E FOP DM FKDQJH LV P RQVRIUQ VMH FRXQW V Z DMU
UHRXUJH EDH \$ UHGFWNRQ LQ JODFDUHUHLYH/ D GHFUHDH LQ VQRZ FRYHU LQ VMH FRXQW V
P RYQMLQV DQG FKDQJHV/LQVMH HILQGFDMU/FRQMIEXMVR DG FUDVH LQ VMHYROP HRI I UHK Z DMU
LQ UYHV DQG QNHV 7 KLV KDV D QHJDNYH IP SDFWRQ VMH DYDDELDW RI Z DMU I RU GUJQLQJ
DJUFXOMUDODDQ LGGVMDDOQHGV > @ & OP DM FKDQJH FDXVH/FKDQJHV/LQVMH K GURUJLFDUHUJLP H
RI UYHV DQG UYHUEDLQV Z KLFK DOR DIFHWEDMF Z DMU UHRXUJH/DQG QDG/VR Z DMU VFDUJLV
DQG FRQ QFWEHIZ H Q GU I H U QV Z DMUXHV

(IIFMYH Z DMU P DQJHP HQVQ D FKDQJLQJ FOP DM UHTXUJH/VMH GHYHOBSP HQVRI DQSDVNRQ
VNDMUJLV/DQG P HDXUJH LQFOXGLQJ IP SURYLOJ Z DMUXVHI I L FCF HJ SDQGLQJ Z DMUVRUDJH DQG
GLVMEXNRQ DQG VMHQJVMHQJ V VMH V DQG UHSRQGLQJ VR Z DYH FULHV , VLV DOR IP SRUJQ/VR
FRQGLU VMH SRMDDO/FRDODDQ HQYURQ HQDOP SDFWRI FOP DM FKDQJHZ KH Q GHYHOBSPQ DQG
IP SOP HQVQJ Z DMU UHRXUJHP DQJHP HQVSRDFH > @

. \UJ] VDDQ DMYHD SUHFLSDM/ DQG LV EHQJ IP SOP HQVQ LQ LQMLDNRDODDQ UHJLQDQ
LQVNDYH/RQ Z DMU UHRXUJH/P DQJHP HQV VFK DV VMH & HQNDQ\$ VDDQ : DMU & FRSHUDNRQ
& \$ (& , VLV DQ IP SRUJQ/SDMVRP I RU GLDORJXH DQG FRSHUDNRQ EHZH Q VMH VDMV RI VMH
UHJLQ LQ VMH I L HGR I Z DMU P DQJHP HQV Z DMU HQJH V VMH DQDELDW DQG RMIH LVMXHV > @

. \UJ] VDDQV SUHFLSDNRQ LQ VFK LQVNDYH/FRQMIEXM/VR VMH RQJRLQJ JODFDUHUFRMNRQ RI
Z DMU LVMXHV HQXUJQ VQDFG UHSRQLELDW I RU P DQJLQJ UHJLQDQZ DMU LVMXHV DQG HQXUJQ
I DUDFFHWVR VMH P I RUDQ& HQNDQ\$ VDDQFRXQMIH/

\$ FMYHD SUHFLSDM LQ LQMLDNRDQ LQVNDYH/ VFK DV & \$ (& . \UJ] VDDQ VMYH/VR
HMDQK QJ VMH P SDUHQVLSV Z LK QHJKERUJQ VDMV DV Z HODV/RMHUVMH KRQHV/ Z LMLQ
Z KLFK RUDQJ DNRQV HJ SHUV DQG GRQJRYHQP HQDORJ DQJ DNRQV DUH HJ SDQGLQJ 7 KLV DQZ V
VMH FRXQW VR VRLQ Q GHYHOB DQG IP SOP HQVNDMUJHVI RUP DQJLQJ Z DMU SUREOP V VDH LQAR
DFFRXQVMH LQMUJW RI DQ SUHFLSDQV DQG FRP SO Z LK VMH SUJLSON RI MVMFH DQG
GHYHOBSP HQV @

'LVFXVVLRQ

) XCFWRQ/R I JRYHQP HQVERGLH/LQVMH I L HGR I Z DMU UHRXUJH/P DQJHP HQV
: DMU UHRXUJH/DUHQDQ LQMUJODHOP HQVRI QH RQ (DUJK SURYLOJ GUJQLQJ Z DMU VSSRUJQ
HFRX VMH V DQG VSSRUJQ LGGVMDDO DQJ DJUFXOMUDOQHGV 0 DQJLQJ VMH H UHRXUJH LV D
FULWFDQ XCFWRQ I RU VRFHW UHTXUJQ HIFMYHFRQDERUDNRQ EHZH Q JRYHQP HQV DJHQFLH/DQG
RMHUVONKRQHV 7 KLV SDSHUJ DP LQV VMH P DQJ XCFWRQ/SHURP HGE JRYHQP HQV DJHQFLH/
LQVMH I L HGR I Z DMU UHRXUJH/P DQJHP HQV DV Z HODV VMH URGH LQ HQXUJQ VMH VMLQDEGHXV
DQG FRQHUJ DNRQ RI Z DMU UHRXUJH / HW FRQGLHJDEUJ RYHUYLZ RI VMH P DQJ XCFWRQ/R
JRYHQP HQVERGLH/LQVMV/DUH

) XCFWRQ/R VMH 0 LQVM RI 1 DMUDQ5 HVRXUJH (FRQJ\ DQG 7HFKQFDQ6XSHUJLVRQ RI VMH
. \UJ] 5HSEXDF

GHYHOBSP HQV/DQG IP SOP HQV DNRQ RI VDM SRQF DQG FRRLQDNRQ LQ VMH I L HGR RI
HQYURQ HQDQSDURMVRQ HFRQJ\ DQG FOP DM JHFRQJ\ DQG VEXRLOXV XVH DQG SURMVRQ RI
QDMUDUHUHRXUJH/ LQFOXGLQJ Z DMU UHRXUJH/ Z LK VMH HJ FHSVRQ RI LUJ DNRQ DQG UH FOP DNRQ
LQUDXKFMUH

IP SOP HQV DNRQ RI VDM FRQNRDQDQ VSHUYLVRQ RYHU FRP SDQDFH Z LK HQYURQ HQDQ
LGGVMDDO/DH V P LQJ V D H V DQG VEXRLOSURMVRQ UHTXUJHP HQV

P RQVRIUQ RI Z DMU SROXNRQ

P RQVRIUQ RI JURXQZ DMUTXDDW K GURJHFRQJ\

VMH DP RYQARI QDMUDUHUHRXUJH/DQG RSHUDNRQDQHUHLYH/RI JURXQZ DMU K GURJHFRQJ\

> @

7KLV DJHCF GHYHBSV WDMJLHV DQG SROFLV DLP HG DVMH VXWLDQDEH XVH DQG SURMFWRQ RI ZDMU UHXRUFV , WGHMUP LQHV SUJLUV DJHV I RU VMH GHYHBSP HQVRI Z DMUP DODJHP HQV DGG IP SÖP HQV P HDXUH VR SUHYHQV DGG UGXFH QHJ DNYH LP SDFW RQ VMH HQYLURCP HQV(WDEOMKH/ UKÖV DGG UHXRUMRQ/ I RU VMH XVH RI Z DMU UHXRUFV LVXHV ÖFQHV I RU VMH LVXHV P RQVUV FRP SÖDGFH Z LVK Z DMU ÖU LV DNRQ DGG P RQVUV VMH FRGGVWRQ RI Z DMU ERGHV (QJDJHG LQ VMH SURMFWRQ DGG UHXRUMRQ RI DTXDNF HFRV VAP V WÖNLQ P HDXUH VR SUHYHQV SROXWRQ RI Z DMU ERGHV SURMFWERGLYLVW DGG UHXRUF ÖWVZ DMU UHXRUFV 3DUMVSDM LQ LQMLÖDNRÖD SURMFW DGG DJUHP HQV DLP HG DMFRSHUDNRQ LQ VMH ILHÖ RI Z DMU UHXRUFV P DODJHP HQV HJ FKÖQH RI HJ SHUHFH DGG WFKRÖU\ WÖQHU 3URYLGHV LQ RUP DNRQ VXSSRUV DGG WÖLQJ VR VMH SXEÖF SURYLQJ ÖDÖ RQ VMH WDMRI Z DMU UHXRUFV P HMÖRQ RI VMH LVXHV DGG SURMFWRQ DVZ HÖD FRGGVWQJ HGF DNRÖDHYHQWRQZ DMUP DODJHP HQVXHV

) XCFWRQ/RI WHO LQVM RI \$JUEXOMUHRI VMH. \U\ 5HSXEÖF

GHYHBSP HQV DGG IP SÖP HQV DNRQ RI SROFLV LQ VMH ILHÖ RI WDMRÖD DGG HILFLHQVXHV RI Z DMU UHXRUFV/LQVMH ILHÖ RI LUUV DNRQ DGG DGG UHÖP DNRQ

SÖDQJ DGG RJ DQJ DNRQ RI LQMLVDM GLVMEXWRQ RI Z DMU UHXRUFV

FRÖLÖDNRQ RI DVMVMH VR UHXRUM VMH XVH RI VXUDFH DGG JURXÖZ DMU VXSSÖHG IURP WDMZ DMUP DODJHP HQV VAP V

7KH 0 LQVM GHYHBSV SURJUP V DGG WDMJLHV I RU VMH XVH RI Z DMU I RU DJUEXOMUD SXLSRVH/ HQXUQJ VXWLDQDEÖW DGG HILFLCF LQVMH XVH RI Z DMU UHXRUFV/LQVMH UXUDVFRU 3URP RUV VMH LQMRGFWRQ RI WFKRÖU LHV DGG P HMÖRQ/ DLP HG DVMH HFRÖP LFDXVH RI Z DMU UHXRUFV VFK DV GUS LUUV DNRQ PRGH LQ LUUV DNRQ P HMÖRQ/ DGG GUDQJH 6XSHYLVH/ FRP SÖDGFH Z LVK UKÖV DGG UHXRUMRQ/ I RU VMH XVH RI Z DMU E DJUEXOMUD ÖVM SUHV LVXHV DSSURSUDM SHUP LW DGG ÖFQHV 3URYLGHV DMLVÖFH LQ FUDMÖJ DGG IP SURYLQJ Z DMU VXSSÖ DGG VÖQV DNRQ V VAP V LQ UXUDÖUHV Z KFK KHSV LP SURYHDFHW VR FÖDQZ DMU DGG UGXFH VMH UÖN RI FRÖP LQ DNRQ RI Z DMU UHXRUFV 3URYLGHV FRQXÖDNRQ/ DGG RJ DQJ HVMÖLQJ SURJUP V I RU DJUEXOMUD ÖSURGXFV RQ VMH WDMRÖD XHV RI Z DMU UHXRUFV DGG VMH LQMRGFWRQ RI P RGH LQ P HMÖRQ/ DGG WFKRÖU LHV LQ DJUEXOMUH> @> @

7KH IXCFWRQ/RI WHO LQVM RI \$JUEXOMUHRI VMH. \U\ 5HSXEÖF LQ VMH ILHÖ RI Z DMU UHXRUFV P DODJHP HQV DLP HG DMHÖXUQJ VXWLDQDEH GHYHBSP HQVRI DJUEXOMUH DGG HILFLHQVXHV RI Z DMU UHXRUFV VR HQXUH IRRV FXUM DGG HQYLURCP HQV DFRQHYDNRQ

) XCFWRQ/RI. \U\ K GURPHV

FRGGVWQJ V VAP DMF REVHYDNRQ/ RI K GURÖJLÖD VÖRZ DYDÖGFH JÖFLRÖJLÖD FRÖLWRQ/ VXUDFH Z DMU SROXWRQ

P DNLQ I RU FDMW UYHU Z DMU FRQMDV Z DMU LQ ÖZ LQ UHMYRVU/ DYDÖGFH FRGGVWRQ/ ÖDMÖDÖK GURP HARURÖJLÖD ÖSKRÖP HÖD DGG HJ WFP HÖ KJK ÖMYÖRI HQYLURCP HQV DÖSROXWRQ

V VAP DMF DÖDÖ VLV DGG V ÖMHV/RI LQ RUP DNRQ RQ VMH FXUHÖK/ GURÖJLÖD FRGGVWRQ/ DV Z HÖDV RQ HQYLURCP HQV DÖSROXWRQ RQ VMH VMUUVU RI VMH. \U\ 5HSXEÖF HQXUQJ VMH SUHSDUDNRQ DGG SXEÖF DNRQ RI DUJLVUURI VÖRZ DYDÖGFH/ DGG P DQMLQJ VMH UFDÖGVMH/

IP SÖP HQV DNRQ RI P HDXUH VR HQXUH SURMFWRQ RI VMÖP HQV DGG I DFLQVH IURP P XG ÖZ V DGG I ÖRGV/ FRQVMFWRQ RI P XG ÖZ SURMFWRQ VMFVMH HQXUQJ VMH RSHUDNRQ RI VMH HQV LQ HUQJ VMFVMH

. \U\ K GURPHV VAP DMF DÖDÖ FRÖFW DGG DÖDÖ JH ÖDÖ RQ VMH ÖM DGG TXDÖW RI Z DMU LQ UYHV ÖNHV DGG RUV ERGHV RI Z DMU DV Z HÖDV RQ Z DMU FRQXP SÖRQ DGG Z DMVZ DMU GLSRVÖD 7KLV LQ RUP DNRQ LV XVHG VR LGQVM VMÖG/ LQ Z DMU UHXRUFV DGG WÖNH ÖFH WÖV P HDXUH VR P DODJHP ' HYHBSV I RU FDMW I RU I ÖRGV GURXJKW DGG RUV HUJ WFP HZ DMU HYHQV UHDMG VR Z DMU UHXRUFV 7KH I RU FDMW KHS JRYLÖP HQV DJHCFHV DGG VMH SXEÖF WÖNH P HDXUH VR SUHYHQV ÖP DJH DGG P LQ P UH ÖMV/ 3URYLGHV D Z LGH UÖQH RI XVHV Z LVK LQ RUP DNRQ RQ VMH WDMV DGG I RU FDMW RI Z DMU UHXRUFV LQ FÖGQJ ÖDÖ RQ Z DMU ÖMYÖ UHMYRVU UYHU I ÖZ SDMLQV DGG RUV SÖDUP HMU/ ÖFH WÖV IURP DNLQ GFLVRQ/ LQ VMH ILHÖ RI Z DMU UHXRUFV P RQVUV DGG P DODJHP HQVRI Z DMU UHXRUFV HJ FKÖQH RI HJ SHUHFH

DOG VFKCQRJ\ WDCVHU & RQGFVUHMDFJK Z RUNRQZ DMUJHXRUFH/VLXHV/DLP HGDVGHYHBSLQ
QZ P HMRG/DOG VFKCQRJLHVI RUP RQVRLQJ DOG P DOQJLQJ Z DMUV VMP V> @ > @

7KHIXCFWRCV/RI . \UJ\ K GURP H\SDO\ DO LP SRVDCVVRCHLQH\QXUJQJ H I H\WVHP DOQJHP HQV
RI Z DMUJHXRUFH/LQ. \UJ\ WDC DOG V\SSRUWQJ V\WDCQDCEQ\G\YHBSLQ HQVRI VMHFRXQW

) XCFWRCV/RI VMH' HSDUJF HQVRI ' LVFDMH3 UHYHQNRQ DOG 6VDM6DQWU DOG(SLGPIRCHUJLFO
6XUJH\CDQFHRI VMH O LQVWV RI + HDQKRI VMH. \UJ\ 5HSEXDF

P RQVRLQJ VMH TXDDV RI VRXUFV/RI GUJQJLQJ Z DMUV\SSO VR VHWOP HQV JURXGG DOG
V\UJDFHZ DMU/ DOG UHFUJHVRDO P LQ\UDODOG VMHUP DOZ DMU/

7KH' HSDUJF HQAP RQVRLV VMH TXDDV RI GUJQJLQJ Z DMU LQFGQJ DOQJLQJ Z DMU J RV VMH
FRQMQVRI KQJ P\XO\XE\WDFH\ DOG P LFURRJDO P V\WDFDQ FDVH GLVDMH/LQSHRSH' HYHBSV
DOG LP SOP HQV SURJUDP V DOG DFVWLVH/IRU VMH SUHYHQNRQ RI LQ HFWRXV GLVDMH WDCP LVWV
WLRXJK Z DMU VFK DV FKROUD G VHQMJ K\SDUJW \$ DOG R\WLV &RQGFV LQSHFWRCV/RI
SOP ELQ V VMP V Z DMU WDFH/HQ\SDQV DOG R\WLV DMUV\SSO IDFLQWV\VR HQ\XUJFRP SODFH
Z LK VQWU UHTXUJF HQV DOG WDCGUV/ 3URYLGH/LQRUP DNRC V\SSRUW DOG FROGFV WDCGJ
HYHQV IRU VMH SRSXDNRC DOG Z DMUV\SSO Z RUNHV RQ LVXHV/RI VDHV DOG KJ JH\QF RI Z DMU
FRQJXP S\NRQ 3DUVLSDM LQ LQVWV SURVFW DOG SURJUDP DFVWLVH/ Z LK R\WLV JRYHUJ HQV
DV\WRLVH/ DOG LQ\WDCVVRCHLQJ DNRC/ RQ LVXHV RI Z DMU UH\XRUFH P DOQJHP HQV DOG
HQXUJQJ VMH VDHV RI GUJQJLQJ Z DMU> @> @

7KH-H IXCFWRCV/ KH\S HQXUH VMH VDHV DOG TXDDV RI Z DMU IRU VMH SRSXDNRC RI
. \UJ\ WDC DVZ HODV\SUHYHQVMHVSUJHGRI LQ HFWRXV/GLVDMH/DV\FDQZ LK Z DMU UH\XRUFH

) XCFWRCV/RI VMH' HSDUJF HQVRI VMH' HYHBSLQ HQVRI ' UJQJLQJ : DMU6XSSO DOG 6DQWNRQ
RI VMH 6VDM \$JHCF IRU \$UFLWV\WV & RQVM\FWRQ DOG + R\VLQ DOG & RP P XQCO6H\VFH\XCGHU
VMH & DELCHVRI O LQVWV RI VMH. \UJ\ 5HSEXDF

IP SOP HQDNRC RI DFVWLVH/LQ VMH ILHG RI G\HYHBSLQ HQVRI FFQNDQJ HG GUJQJLQJ Z DMU
V\SSO DOG VQWNRQ RI SRSXDNRC DUHV

FUJDNRC RI DGDVDMH RQ FFQNDQJ HG GUJQJLQJ Z DMUV\SSO DOG VQWNRQ RI SRSXDNRC
DUHV

7KH' HSDUJF HQ\GHYHBSV\OQJ WUJ DOG V\RUVWUJ V\WDMH\IRU VMH G\YHBSLQ HQVRI Z DMU
V\SSO DOG VQWNRQ LQ UDMXFMUJ GHILQJ SURJUDP DUHV DOG G\HYHBSLQ HQVIRDOY 6XSHU\LVH/
FRP SODFH Z LK VQWU DOG KJ JH\QF UHTXUJF HQV IRU VMH TXDDV RI GUJQJLQJ Z DMU FRQNRQV
VMH RSHUDNRQ RI Z DMUV\SSO V VMP V DOG Z DMU WDFH/HQ\SDQV DOG R\WLV SODQJLQJ
DOG LP SOP HQDNRC RI SURVFW IRU VMH FRQW\FWRQ RI QZ Z DMUV\SSO QHZ RUV SXP SLQ
VDMRCV/ Z DMU WDFH/HQ\SDQV DOG R\WLV LQ UDMXFMUJ VR SURYLGH VMH SRSXDNRC Z LK
GUJQJLQJ Z DMU DOG FRDFV DOG WDFH\Z DVNZ DMU' HYHBSV DOG LP SOP HQV P HDXUHV VR HQXUH
VMH DV\WDCQFH RI TXDDV GUJQJLQJ Z DMU IRU DMU J HP HQV RI VMH SRSXDNRC LQFGQJ UH R\WLV
DOG UJUDUJHV , QMDFW Z LK LQ\WDCVVRCHLQJ DNRC/ DOG ILQDFDQWNRQV\VR DMUJFV
LQ\WV HQ\ DOG VFKCQRJ\ WDCVHU & RQGFVUHMDFJK LQ VMH G\YHBSLQ HQVRI Z DMUV\SSO DOG VQWNRQ V VMP V
LQ VMHFRXQW > @ > @

7KH-H IXCFWRCV/ KH\S SURYLGH VMH SRSXDNRC RI . \UJ\ WDC Z LK KJ\K TXDDV GUJQJLQJ Z DMU
DOG FUJDNRC FRQV\WRCV/IRU LP SURYLQJ VMH VQWU DOG KJ JH\QF V\WDCVVRCHLQ VMHFRXQW

) XCFWRCV/RI VMH1 DNRC DOG V\WDFDQZ & RP PLWVH

IP SOP HQDNRC RI RILFDO VDMWDFDQ DFVWLVH/RQ VMH SUJLSOV RI SURH\VRDO
LQGH\CG\QFH DOG DVNRCP\ DOG FRRUGLQNRQ RI DFVWLVH/LQ VMH ILHG RI DFRXQNDQJ DOG
VDMWDFV WLRXJKR\WV VMH V\UJLV RI VMH. \UJ\ 5HSEXDF 7KH1 DNRC DOG VDMWDFV & RP PLWVH
FRDFW DOG SURFHWV LQRUP DNRC RQ VMH WDM DOG XVH RI Z DMU UH\XRUFH\ WLRXJKR\WV
V\UJLV RI VMH. \UJ\ 5HSEXDF 7KL\ LQFGHV GDV RQ VMH GLVWEXNRQ DOG XVH RI Z DMU LQ
YUJRVV\FRUV/RI VMHFRCP\ VDMWDFV/RQZ DMU GLVSRVDODGZ DVNZ DMU DOG VMHFRQV\WRQ RI
Z DMU ERGHV & RP SLQ VDMWDFDQ UFRUW DOG SXDFDNRC/ RQ Z DMU UH\XRUFH\ WDV\ SURYLGH
RILFDO VDMWDFDQ LQRUP DNRC IRU JRYHUJ HQV\UHMDFJK VMHSEXDF DOG R\WLV LQ\WJHWV SDUWV/
O D SDUWLSDM LQ VMH G\YHBSLQ HQVRI P HMRG/IRU FRDFV DOG GDV RQZ DMU UH\XRUFH\ WDCGUV
IRU FDMUJLFDNRQ DOG FRGJ RI VDMWDFDQ LQRUP DNRC Z KLFK HQXUH LV TXDDV DOG

FRP SUIELOW 0 D. SURYLGH DGYLFH VR JRYHQP HQVDJHCFHV LQMLQDNRQDORUJ DQJ DNRQV DGG
RMHU LQMUHVMAG SDUWV RQ VNH FRQDFWRQ DQDQV DGG XVH RI VDMVWFOLQ RUP DNRQ RQZ DMU
UHRXUHV/> @ @

, Q DGGWRQ VNH1 DNRQDQ FDGP\ RI 6FLHCFH/RI VNH. \U\ 5HSXEF KJJKUHGXFDNRQDQ
LQVMMNRQ/ LGGVM DGG LQMLQGGVM UHMDUK LQVMMNRQ/ DUH ZRUNQJ VR SURYLGH VNH
VLFHQWLF IRXGGDNRQ/ DGG WDLQJQ GHFMQV IRU P DNQJ P DQDHP HQVGFVLRQ/ &RGGFV
UHMDUK RQ VNH VDM DGG G QDP LEV RI Z DMU UHRXUHV DQDQJ HVMHFDXVH/DGG FRQHTXHQFHV/RI
FKDQJH/ DGG DQR GHYHDS P HMRG/ DGG WFKQRJLHV IRU VNHU P DQDHP HQV6FLHCFHV DGG
VSHFDQWV FRQGFVWLFHQWLF UHMDUK VR GHYHDS P HMRG/ P RGHV DGG VADMULHV IRUZ DMU
UHRXUHV P DQDHP HQVMDVFDQ EH XVHG EA JRYHQP HQVDJHCFHV ZKHQ P DNQJ P DQDHP HQV
GFVLRQ/ + LJKUHGXFDNRQ LQVMMNRQ/ SURYLGH HGFDMNRQDQ SURJUDP VLQK GURJ\ KI GUDXF
HQJLQHUIQJ HFRJ\ DGG RMHU Z DMU UHRXUHV/ UHDMG VSHFDQWV SURYLQJ WDLQJQ IRU
TXDQJLHG VSHFDQWV VR ZRUN LQ VNH I LHG RI Z DMU UHRXUHV P DQDHP HQV6FLHCFHV UHMDUK
LQVMMNRQ/ DGG DFDGP LH/ RI VLFHCFH SURYLGH DGYLFH DGG HJ SHUWVH RQ Z DMU P DQDHP HQV
LVXHV/ KHSLQJ JRYHQP HQWP DNHLQ RUP HGGFVLRQ/

Water management system

\$ GFVLRQ P DNQJ YHVMFODIRUZ DMU UHRXUHV P DQDHP HQV KDV EHQ EXQV: DMU DGG DGG
UHRXUHV LVXHV/RI FRQWV GHYHDSP HQV DGG SURMFWRQ RI Z DMU UHRXUHV/ DUHFRQLGHUHLQD
FRP SUHKQVLYHP DQGHU

&XUHQV VNH1 DNRQDQ RXCFQRQ: DMU DGG/ DGG 5HRXUHV XCGH VNH3UHLGHQVRI VNH
. \U\ 5HSXEF KD/EHQ FUDMG 7KH&KQUP DQ/LV VNH3UHLGHQVRI VNH. \U\ 5HSXEF KLV
GSHVH/DUH VNH&KQUP DQ/RI VNH&DELQVRI 0 LQVMU/RI VNH. \U\ 5HSXEF DGG VNH0 LQVMU
RI 1 DMUDQ5 HRXUHV/ (FRJ\ DGG 7FKQLFDD6XSHUVMRQ RI VNH. \U\ 5HSXEF

7KH P DQ VDMV DGG XCFWRQ/RI VNH1 DNRQDQ RXCFQDUH FRRLGDMRQ RI VNH DVMVWV/RI
P LQVMU/ DQ LQVMDVH GSDUW HQV DGG RMHU JRYHQP HQVERGHV IRU VNH P DQDHP HQV RI
Z DMU DGG DGG UHRXUHV VNH LVXV DGG SURMFWRQ> @> @

7KH XCFWRQ/RI VNH VFUHQDVAR VNH1 DNRQDQ RXCFQDUH DMJ QGHV VNH DMVRUJ HGERG
LQ VNH I LHG RI QDMUDUHRXUHV/RI VNH. \U\ 5HSXEF

\$ FRRLGQJ VR 5HRXUVRQ RI VNH&DELQVRI 0 LQVMU/RI VNH. \U\ 5HSXEF 1 R QDMG
1 RY P EHU JRYHQP HQVERGHV/ KDY EHQ UHRUJ DQJ HG 7KH DMVRUJ HG HQVURCP HQMD
SURMFWRQ DJHCF KDV D VSHFDQJ HG XQVUHSRQMEGH IRUZ DMU UHRXUHV 7KLV P DGHVSRMEGH
VR VSHUDM SRQVFDQD VSHVW URP HFRQRP LF UHXDMRQ DGG FRQLGHUP DQDHP HQV/DI XCFWRQ
\$ QZ GLVLRQ KDV EHQ FUDMG Z LVMQ VNH HQVURCP HQMD DMVRUJ GDDQJ Z LK LVXHV/RI
Z DMU DGG DGG UHRXUHV DGG VHUJQ DV D ZRUNQJ ERG RI VNH VFUHQDVAR VNH1 DNRQDQ
&RXCFLO: DMU UHRXUHV P DQDHP HQVDMH QFDQYHOZ LQEH FDUJHG RXVMURXJK UHJLRQDQ
EUDQFH/RI VNH0 LQVMU RI 1 DMUDQ5 HRXUHV/ (FRJ\ DGG 7FKQLFDD6XSHUVMRQ RI VNH
. \U\ 5HSXEF> @

7R FUDMD VMDQDEGH Z DMU UHRXUHV P DQDHP HQV VMP Z LVMQ EDVQ/ GFVLRQ P DNQJ
Z LQKDYHV EHQXUHGDMHUHJLRQDQ DNRQDQ DGG QFDQYHV

6VDMUJLFDGG SURJUDP GRFXP HQVRI VNH. \U\ 5HSXEF

7KH P DQ VSHUDQREMFVWV DGG LGGFDVU/ UHDMG VR Z DMU DUH UH QFVWG LQ VNH VDMUJLFDGG
SURJUDP GRFXP HQVRI VNH. \U\ 5HSXEF

1 DNRQDQ HYHDSP HQV6VDMU\ RI VNH. \U\ 5HSXEF IRU DSSURYHGE ' HFUHR
VNH3UHLGHQVRI VNH. \U\ 5HSXEF QDMG2 FVREHU <

1 DNRQDQ HYHDSP HQV8URJUDP RI VNH. \U\ 5HSXEF XQMD DSSURYHGE ' HFUHR VNH
3UHLGHQVRI VNH. \U\ 5HSXEF QDMG2 FVREHU <

6VDM SURJUDP IRU VMH GYHQBSP HQ/RI LUJUDNRQ RI VMH. \U\] 5HSXEOF IRU
DSSURYHGE ' HFUHR VMH* RYHUCP HQ/RI VMH. \U\] 5HSXEOF GDMG-XO
3URJUDP IRU VMH GYHQBSP HQ/RI GULQLOJ Z DMU VASSO DOG VDUJDNRO V VMP V LQ SRSXODNG
DUHD/RI VMH. \U\] 5HSXEOF XQMD DSSURYHGE ' HFUHR VMH* RYHUCP HQ/RI VMH. \U\]
5HSXEOF GDMG-XQH < HW > @

& R Q F O X V L R Q

7KLV DUWFOH SURYLGH G DO DODO WFOOD VMHP HQ/RI VMH URDH RI VDM LQMMNRQ/LQ VKDSLQJ Z DMU
UHRXUHV/P DODJHP HQ/SROFLV/LQ. \U\] VDO 6VDM LQMMNRQ/SOD DQIP SRUJQVVRDILQZ DMU
UHRXUHV/P DODJHP HQ/LQ. \U\] VDO DFWQJ DV RUJDOJ HV DOG UHJXODMUV RI Z DMU UHDMNRQ/DV
VMH VDM OM O-%DIHGRO VMH UHXOVR VLV Z RUN VMH IRDZ LOJ FRGFOXMRQ/DH SURSRVHG
,VLV LP SRUJQVVR SD P RUH DMNRQ VR VMH GYHQBSP HQ/DOG LP SOP HQDMNRQ RI
HIFWYH VDMUHV DOG P HFQDQV V IRU Z DMU UHRXUHV/P DODJHP HQ/LQFOXGLOJ VMURXJK
VMHQ/VMHQJ FFRSHUDNRQ EHIZHQ JRYHUCP HQ/LQMMNRQ/ OFDO FRP P XQVMH DOG
LQMMNRQDORUJDOJ DNRO/

6XFFHW XO LP SOP HQDMNRQ RI Z DMU UHRXUHV/P DODJHP HQ/SROFLV DOR UHTXUHV
DFWYH SXEOLQYROP HQ/LQFOXGLOJ HGXFDMNRQ DOG DZ DUHQW RI VMH LP SRUJQVVR VVMQDECH
XVH DOG SURMFWNRQ RI Z DMU UHRXUHV/

,P SURYHG FFRSHUDNRQ EHIZHQ YDUKXV JRYHUCP HQ/DJHQFLV LV QHG-G VR HQXUH
HIFWYH/P DODJHP HQ/RI Z DMU UHRXUHV/DOG SUHYHQVFRQ OFW EHIZHQ GLI HUHQVHFVUV/RI VMH
HFRCP\ DOG UHURQ/RI VMH FRXQV ,VLV DOR LP SRUJQVVR VDHILQV DFFRXQVMH LQMMNRQ DOR
VDMH KROHV LQFOXGLOJ VMH SRSXODNRQ DJUEXOMUD HQMSUHV LGGXMMDO FRP SDQHV
HQ/LURCP HQ/DORUJDOJ DNRO/DOG QHJKERUJQ VDMV

,QMMNRQDORUJDOJ FFRSHUDNRQ SD V D NH URD LQ VMH HIFWYH/P DODJHP HQ/RI Z DMU
UHRXUHV/ VMH URH LVLV QFFWQV VR FRQVXV VR VMHQ/VMHQ FFRSHUDNRQ Z LK QHJKERUJQ
FRXQV/DOG UHURDORUJDOJ DNRO/

7KHU LV DOR D QHG VR LQYHWLQ P RGLQ WFKORU\ DOG LQUDMWFMMH VR LP SURYH
Z DMU P DODJHP HQ/LQFOXGLOJ P RQVUJQ V VMP V HIFWYH LUJUDNRQ P HMV DOG
GLVFKDJH FRQVROG UHURVUV

7KHU ILQGLQV KJKQKVMH QHG IRU IXUMHU HIRUV E JRYHUCP HQ/LQMMNRQ/ OFDO
FRP P XQVMH DOG FLYO VRFHW RUJDOJ DNRO/ VR LP SURYH Z DMU UHRXUHV/P DODJHP HQ/LQ
. \U\] VDO \$ FWH LQMMNRQ DOG MLOVH IRUV RI DO VDMH KROHV/ DO FRQVEXM VR VMH
VVMQDECH GYHQBSP HQ/DOG FRQVUJUDNRQ RI VMH FRXQV VZ DMU UHRXUHV/LQVMH GRQ VMP

5 H I H U H Q F H V

1 0 1 XUDHYD : DMU SRMQRORI VMH. \U\] 5HSXEOF SUREOP V DOG SRMQRORI RU
HFRCP LF GYHQBSP HQ/\$5,' (&26<67(06 YRQPH QR S
\$ FFW PRGH

[KMSV/ F EHUBQDQDUX DUWFOHQYRQ\ SRMQRORUHSXEONLNU\ VDO SUREOP\ LSRMQRV
VDO HNRCP LFKHNRJR UJ YLV D](#) DFFHW/GDM

1 , ,YDGRYD 3UREOP VRI Z DMU UHRXUHV/P DODJHP HQ/LQMMNRQ V VMP VRI . \U\] VDO
LQ D P DJHW HFRCP\ \$ FFW PRGH

[KMSV/ ZZZ OFUQRV VVXFK8 SODG%\\$ VUDHY 0 DODJQ](#) Z DMU UHRXUHV
[XSG](#) DFFHW/GDM

%0 ']KCEDY &OPDM FKQJH DOG ELRGLYUW \$ FFW PRGH
[KMSV/ P QHQHNSUHV RUJ XGZ V XQBSRW](#) DFFHW/GDM

+RZ GRV FOPDM FKQJH DIFW DJUEXOMH \$ FFW PRGH
[KMSV/ ZZZ Z DMU RYNU LGH SKS' RSWRQ FRP BN YLZ WMP LG](#) NDLR REUJR

[P U P HQ Q L D N O P D D Y O D X W Q D V H O N R H N K R I \ D M W R , W P L G](#) [O O J U X](#) G D M R I
D F F W
& H O M D O \$ V D 5 H J L R Q D O (F R O P L F & R R S H U M R Q & \$ 5 (& ' H Y H O S P H Q V R I W H Z D M U
F R P S R Q H Q V \$ F F H W P R G H
[K M S V Z Z Z F U H S U R J U P R U J X S O D G V 6 X P P D U R I , Q M D O 5 H J L R Q D O & R Q X O D M R Q 5 8 S G](#)
D F F W G D M
5 (* 8 / \$ 7 , 2 1 6 R Q W H O L Q W M R I 1 D M D O 5 H R X U F H V (F R O U \ D O G 7 H K Q L F D O 6 X S H Y L M R Q
R I W H . \ U \] 5 H S X E O F \$ S S U R Y H G E ' H F U H R I W H * R Y H O P H Q V R I W H . \ U \] 5 H S X E O F R I
1 R Y P E H U 1 R \$ F F H W P R G H
[K M S V F E G P L Q M W M R Y N J](#) [H G W R Q](#) [U X](#) G D M R I D F F W
1 D M R Q D O Z D M U W A D M U R I W H . \ U \] 5 H S X E O F X Q M D \$ F F H W P R G H
[K M S V F E G P L Q M W M R Y N J](#) [H G W R Q](#) [U X](#) D F F W G D M
5 (* 8 / \$ 7 , 2 1 6 R Q W H O L Q W M R I \$ J U I F X O M U H D O G / D O G 5 H O P D M R Q R I W H . \ U \]
5 H S X E O F \$ S S U R Y H G E ' H F U H R I W H * R Y H O P H Q V R I W H . \ U \] 5 H S X E O F G D M G) H E X O U
1 R \$ F F H W P R G H [K M S V F E G P L Q M W M R Y N J](#) [H G W R Q](#) [U X](#)
D F F W G D M
5 (* 8 / \$ 7 , 2 1 6 R Q W H + \ G U R P H M R U R Q L F D O 6 H U Y L F H X Q G U W H O L Q W M R I (P H J H O F
6 L M D M R Q V R I W H . \ U \] 5 H S X E O F \$ S S U R Y H G E ' H F U H R I W H * R Y H O P H Q V R I W H . \ U \]
5 H S X E O F G D M G 1 R Y P E H U 1 R \$ F F H W P R G H
[K M S V F E G P L Q M W M R Y N J](#) [H G W R Q](#) [U X](#) G D M R I D F F W
5 (* 8 / \$ 7 , 2 1 6 R Q W H ' H S D W F H Q V R I ' L V H D H 3 U H Y Q M R Q D O G ([S H U W H R I W H O L Q W M R I
+ H O X R I W H . \ U \] 5 H S X E O F \$ S S U R Y H G E ' H F U H R I W H * R Y H O P H Q V R I W H . \ U \]
5 H S X E O F G D M G - D O X U J 1 R \$ F F H W P R G H
[K M S V F E G P L Q M W M R Y N J](#) [H G W R Q](#) [U X](#) D F F W G D M
5 (* 8 / \$ 7 , 2 1 6 R Q W H ' H S D W F H Q V R U W H ' H Y H O S P H Q V R I ' U I Q N Q J : D M U 6 X S S O D O G
6 D Q M D M R Q X Q G U W H 6 W M \$ J H O F I R U \$ U F K M F M U H & R Q M K F M R Q D O G + R X L Q J D O G
& R P P X O D O 6 H U Y L F H X Q G U W H & D E L Q V R I O L Q W M V R I W H . \ U \] 5 H S X E O F \$ S S U R Y H G E
5 H R O M R Q R I W H & D E L Q V R I O L Q W M V R I W H . \ U \] 5 H S X E O F G D M G) H E X O U 1 R
\$ F F H W P R G H [K M S V F E G P L Q M W M R Y N J](#) [H G W R Q](#) [U X](#) G D M R I D F F W
5 (* 8 / \$ 7 , 2 1 6 R Q W H 1 D M R Q D O 6 W M W F D O & R P P L W H R I W H . \ U \] 5 H S X E O F \$ S S U R Y H G
E ' H F U H R I W H 3 U H L G H Q V R I W H . \ U \] 5 H S X E O F G D M G - X O 1 \$ F F H W
P R G H [K M S V Z Z Z W D W U U X U X O H K W](#) G D M R I D F F W
5 (* 8 / \$ 7 , 2 1 6 R Q W H 1 D M R Q D O & R X Q F L O I R U : D M U D O G / D O G 5 H R X U F H V X Q G U W H
3 U H L G H Q V R I W H . \ U \] 5 H S X E O F W R W H ' H F U H R I W H 3 U H L G H Q V R I W H . \ U \] 5 H S X E O F
G D M G 1 R Y P E H U 1 R \$ F F H W P R G H
[K M S Z Z Z F Z D M U L Q R Q H A Z D M L B Z R U G S G N U J Z D M U F R X Q F L O S G](#) D F F W G D M
2 Q R U J D Q J D M R Q D O P H D X U H / L Q F R Q F M R Q Z L W K W H D S S U R Y D O R I W H W A K F M U H D O G
F R P S R M R Q R I W H & D E L Q V R I O L Q W M V R I W H . \ U \] 5 H S X E O F G D M G 1 R Y P E H U
1 R \$ F F H W P R G H [K M S V F E G P L Q M W M R Y N J](#) [H G W R Q](#) [U X](#) G D M D S S H O