5 5HY

'HFHPEHU

&LW\ RI *UHDWHU *HUDOGWRQ

3RLQW 0RRUH
,QXQGDWLRQ &RDVWDO 3URFHVVHV 6WXG\

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u ‰ Œ}P Œ• ~ ••}]š •‰o 3RLQW 0RRUH ,QXQGDWLRQ &RDVWDO 3URFHVVHV 6WXG\

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creating better coasts and ports

6XLWH 0DLQ 6WUHHW 2VERUQH 3DUN :$
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7DEOH 5HFRPPHQGHG &RVWDO ,QXQGDWLRQ $OORZDQFH 3F

7LPHIUDP	6HD /HYHO P	\HDU $5 P$+'	\HDU $5 P$+'	\HDU $5 P$+'
3UHVHQW				

&RVWDO 3URFHVVHV $OORZDQFHV $VVHVVPHQW

633 UHTXLUHV WKDW RQ D VDQG\ FRDVW DQ DOORZDQFH IRU IXW
LQYHVWLJDWHG 7KLV DOORZDQFH VKRXOG EH PHDVXUHG IURP WKH
DQG VKRXOG LQFOXGH WKH IROORZLQJ HOHPHQWV

$OORZDQFH IRU WKH FXUUHQW ULVN RI VWRUP HURVLRQ

$OORZDQFH IRU KLVWRULFDO VKRUHOLQH PRYHPHQW WUHQGV

$OORZDQFH IRU HURVLRQ FDXVHG E\ IXWXUH VHD OHYHO ULVH

,Q YLHZ RI WKH DVSHFW H[SRVXUH DQG FKDUDFWHULVWLFV RI WKH
ZDV GLYLGHG LQWR WKUHH VHFWRUV WR LQYHVWLJDWH WKH UHVSR
FKDQJHV DVVRFLDWHG ZLWK HDFK)XUWKHUPRUH WKH HURVLRQ DOORZDQFH
EDWK\PHWU\ VXUURXQGLQJ WKH VLWH GHWDLOHG ZDYH PRGHOLQ
LPSURYHG DFFXUDF\ IRU WKH VWRUP HURVLRQ PRGHOLQJ

6WRUP HURVLRQ PRGHOLQJ ZDV FRPSOHWHG XVLQJ WKH 6%($&+ SU
HIIHFW RI D VWRUP ZLWK D LQ \HDU DYHUDJH UHFXUUHQFH LQW
WKH PRGHOLQJ ZDV FRPSOHWHG IRU ERWK D \HDU $5, F\FORQH
D \HDU $5, VRXWK FRDVW VWRUP ± W\SLFDOO\ DVVRFLDWHG ZLWH
0RGHOLQJ ERWK HYHQWV VKRZHG WKDW WKH VRXWK FRDVW VWRU
VKRUHOLQH HURVLRQ ODUJHO\ GXH WR WKH H[WHQVLYH GXUDWLRQ
SRWHQWLDO LPSDFW RI D F\FORQH $V D UHVXOW RI WKH PRGHOL
P KDYH EHHQ SODFHG RQ WKH VRXWK FRDVW GHWHUPLQHG E\ 6%($&+ ZHUH XVHG DV
6 DV VWLSXODWHG E\ WKH 633

6KRUHOLQH PRYHPHQW DQDO\VLV ZDV FRPSOHWHG LQFOXGLQJ UHY
0LGHVW 3RUWV $XWKRULW\ $V D UHVXOW RI WKLV LQYHVWLJDWLRQ
PRYHPHQW KDYH EHHQ GHWHUPLQHG EDVHG RQ WKH REVHUYHG FKD
SHULRG EHWZHHQ *HQHUDOO\ VSHDNLQJ WKHUH KDV EHHQ VRPH
VRXWKHUQ EHDFK *UH\V %HDFK EXW WKH ZHVWHUQ DQG QRUWKHU

6HD OHYHO ULVH DOORZDQFHV IRU WKH VKRUHOLQH ZHUH GHWHUPL
UHTXLUHPHQWV RXWOLQHG LQ 633 $OORZDQFHV RI DQG P

7DEOH RI &RQWHQWV

,QWURGXFWLRQ

*HQHUDO

6LWH 6HWWLQJ

7KH 6LWH

6HGLPHQW &HOOV

6LWH ,QVSHFWLRQ

6WDWH 3ODQQLQJ 3ROLF\

&RDVWDO ,QXQGDWLRQ $VVHVVPHQW

&RDVWDO 3URFHVVHV $OORZDQFHV $VVHVVPHQW

6HD /HYHO 5LVH

&RDVWDO ,QXQGDWLRQ $VVHVVPHQW

&\FORQLF 6WRUP 6XUJH $VVHVVPHQW

1RQ &\FORQLF 6WRUP 6XUJH $VVHVVPHQW

7VXQDPL ,QGXFHG ,QXQGDWLRQ $VVHVVPHQW

5HFRPPHQGHG &RDVWDO ,QXQGDWLRQ $OORZDQFH

&RDVWDO 3URFHVVHV $OORZDQFHV

$FXWH 6WRUP (URVLRQ $OORZDQFH 6

$OORZDQFH IRU 6KRUHOLQH 0RYHPHQW 7UHQG 6

6HD /HYHO 5LVH $OORZDQFH 6

7RWDO &RDVWDO 3URFHVVHV $OORZDQFH

&RPELQHG ,QXQGDWLRQ &RDVWDO 3URFHVVHV 0DSSL

&RQFOXVLRQV

5HIHUHQFHV

*ORVVDU\

$SSHQGLFHV

$SSHQGL[$,QXQGDWLRQ $VVHVVPHQW 3ODQ

$SSHQGL[% ,QXQGDWLRQ 0DSSLQJ

$SSHQGL[& &RDVWDO 3URFHVVHV $OORZDQFH 0DSSLQJ

$SSHQGL[& &RPELQHG &RDVWDO 3URFHVVHV ,QXQGDWLRQ 0DSS

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)LJXUH /RQJ 7HUP 6KRUHOLQH 0RYHPHQW 5DWHV WKH 6

)LJXUH /RQJ 7HUP 6KRUHOLQH 0RYHPHQW 5DWHV WKH 6

7DEOH RI 7DEOHV

7DEOH 6HD /HYHO 5LVH

7DEOH &\FORQLF 6W OR F ìÍ ` ìÍ ` ìÍ ` ìÍ ` ìÍ ` ìÍ ` ìÍ `w9 ìÉÍ ` ì

,QWURGXFWLRQ

*HQHUDO

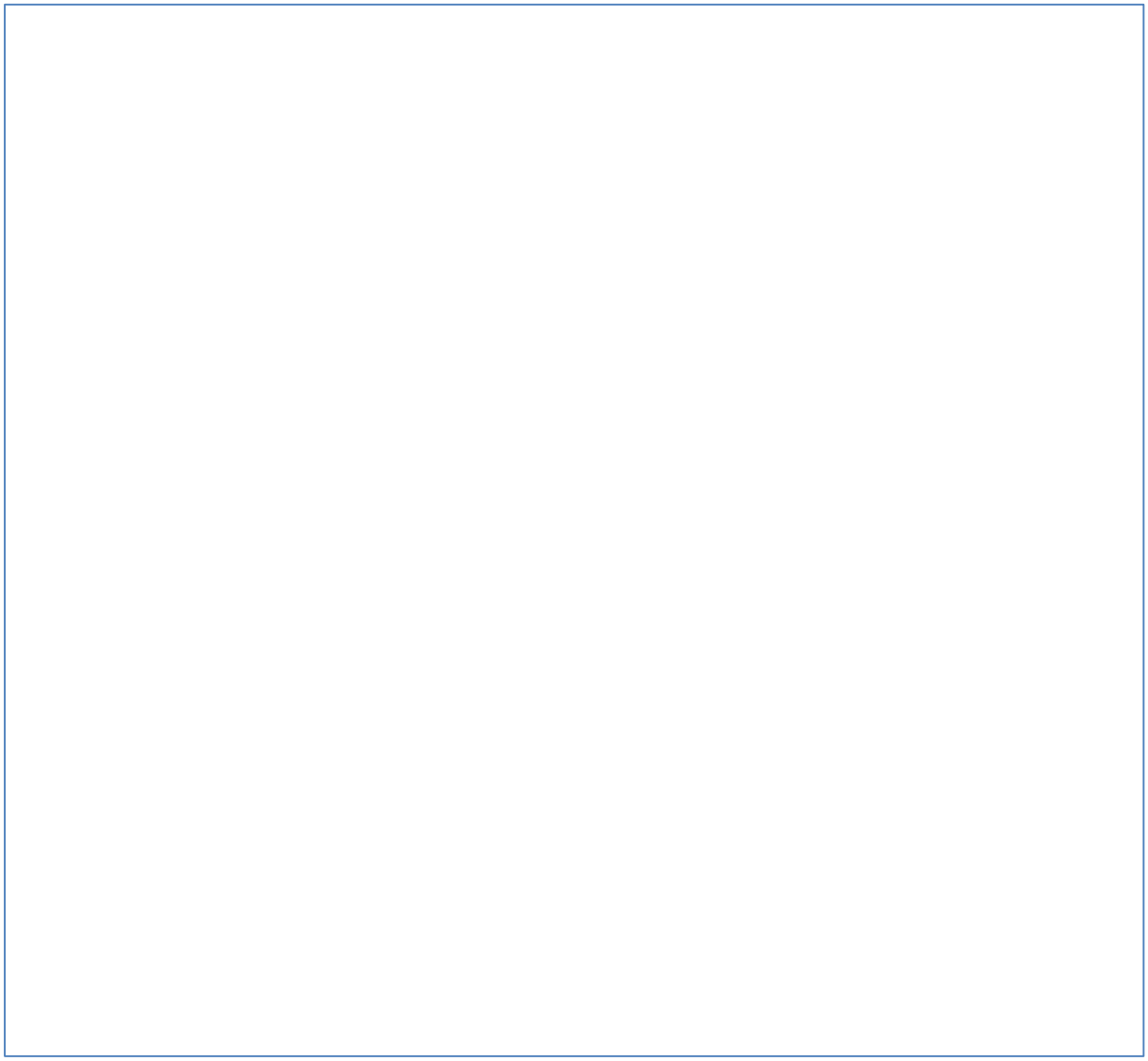
3RLQW 0RRUH LV ORFDWHG LQ WKH &LW\ RI *UHDWHU *HUDOGWRQ R
SURPLQHQW VDQG\ IRUHODQG IRUPHG LQ OHH RI EVRKHQ 3HQWR0RRUH
HDVW E\ -RKQ :LOOFRFN OLQN ZLWK WKH UHPDLQL7QJ SRRUWLRQ R
RI 3RLQW 0RRUH LV VKRZQ LQ)LJXUH

$ FRDVWDO SURFHVVHV VWXG\ KDV SUHYLRXVO\ EHHQ FRPSOHWHG
IRU WKH WKHQ &LW\ RI *UHDWHU *UHHQRXJK QRZ &LW\ RI
$XWKRULW\ QRZ 0LG :HVW 3RUW $XWKRULW\ DQG WKH 'HSDUWPHQ
'HSDUWPHQW RI 3ODQQLQJ DQG 'HSDUWPHQW RI 7UDQVSRUW 'R7
$D\VHRDU 3HDVWDO UWFHVVH`SDQVH`SVHQpDDH p€We`HV 'W p€• HW

6LWH 6HWWLQJ

7KH 6LWH

7KH VKRUHOLQH ZLWKLQ WKH VWXG\ DUHD UHIHU)LJXUH LV SU
DQG[WHQVLYH OLPHVWRQH SODWIRUPV WKDW H[LVWV DORQJ WKH V
)LJXUH 7KLV VWUHWFK RI WKH VKRUHOLQH LV GLVUXSWHG E\ F
DGMDFHQW WR WKH VKRUH 'DPDUD



)LJXUH ([WUDFW IURP /RFDO 1DXWLFDO &KDUW 6RXUFH $+6

)LJXUH 6HFRQGDU\ 6HGLPHQW &HOO QHDU *HUDOGWRQ VR

u ‰ Œ}P Œ• ˜ ••}] š • ‰&0* 3RLQW 0RRUH ,QXQGDWLRQ &RDVWDO 3
. 5HSRUW 5 5HY 3DJH

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6HFWRU H[WHQGV VRXWKZDUGV DORQJ WKH HDVWHUQ H[WHQW RI WKH ZHVWHUQ EUDQFK RI WKH *UHDW 1RUWKHUQ +DUERXU 7KLV VHFWRU FRQVLVWV EHDFK FRPPHQFHV DW WKH VDQG\ IRUHODQG DQG H[WHQGV ZHVW X NQRZQ DV ([SORVLYH %HDFK 7KH VHFRQG EHDFK LV NQRZQ DV WKH EHWZHHQ WKH JUR\QH DQG WKH ZHVWHUQ VLGH RI D NP ORQJ EU SURWHFWLRQ IRU *UHDW +DUERXU

7KLV VHFWLRQ RI WKH VKRUHOLQH JHQHUDOO\ FRQVLVWV RI

)LJXUH ,3&& 6FHQDULRV IRU VHD OHYHO ULVH ,3&&

'HSDUWPHQW RI 7UDQVSRUW FRPSOHWHG DQ DVVHVVPHQW RI W
WKDW FRXOG EH H[SHULHQFHG RQ WKH :HVWHUQ $XVWUDOLDQ FRDV
DVVHVVPHQW H[WUDSRODWHG ZRUN E\ +XQWHU WR SURYLGH V
,3&& $) FOLPDWH FKDQJH VFHQDULR SURMHFWLRQV WR WKH W

)LJXUH 5HFRPPHQGHG 6HD /HYHO 5LVH 6FHQDULR IRU &RDVW :HVWHUQ $XVWUDOLD 'R7

%DVHG RQ)LJXUH UHTXLUHG DOORZDQFHV IRU VHD OHYHO ULVH IUD WLPH IUDPHV DQG DUH SUHVHQWHG LQ 7DEOH

7DEOH 6HD /HYHO 5LVH

7LPHIUDPH	6HD /HYHOP5LVH

5DQN WKH \HDUV RI V\QWKHWLF F\FORQHV XVLQJ WKH ILUV\
FRPELQHG ZLWK WKH SUHGLFWHG WLGH WR GHWHUPLQH WKH WF

8VH WKH 'HOIW ' PRGHO WR VLPXODWH WKH WRS HYHQWV DQG U
0RRUH

&RPSOHWH DQ H[WUHPH DQDO\VLV RI SHDN UHFRUGHG ZDWHU O

)XUWKHU GHWDLOV UHJDUGLQJ WKH DGRSWHG DSSURDFK DQG WKH
LQ WKH IROORZLQJ VHFWLRQV

05$ KDYH SUHYLRXVO\ XVHG WKH DSSURDFK RXWOLQHG DERYH DW D
KDV EHHQ XVHG WR GHWHUPLQH WKH [illegible] DVVHVVPHQW SURYLGHG JRRG DJUHHPHQW ZLWK WKH SUHGLFWLRQ
IURP DQDO\VLV RI WKH KLVWRULFDO ZDWHU OHYHO UHFRUG 7KLV
PRGHOOLQJ PHWKRGRORJ\ FDQ SURYLGH PHDQLQJIXO RXWFRPHV

'HOIW 0RGHO 6HWXS &DOLEUDWLRQ

7KH 'HOIW ' VXLWH RI PRGHOV SURYLGHV DQ LQWHJUDWHG PRGHO D
DWPRVSKHULF SUHVVXUH GLIIHUHQWLDOV ZLQG ILHOGV ZDYH FOL

WKH REVHUYDWLRQ UHFRUG 7R DVVLVW ZLWK WKLV SURFHVV KLVW
'R7 IRU *HUDOGWRQ 3RUW 7KH ZDWHU OHYHO UHFRUG IRU *HUDOG
UHFRUG GDWLQJ EDFN WR :DYH PHDVXUHPHQWV RQ EHQFKPDUN
GHYLFH ZHUH DOVR DYDLODEOH DW WKH HQWUDQFH RI WKH RXWHU
SURYLGHG WR 05$ E\ WKH 0:3$ 7KH ZDYH GDWD SURYLGHV D UHODW
EDFN WR 7KH ORFDWLRQ RI WKH WLGH JDXJH DQG $:$& GHYLFH

)LJXUH /RFDWLRQ RI 7LGH *DXJH $:$& 6RXUFH *RRJOH (DU

:DWHU /HYHO &DOLEUDWLRQ 9DOLGDWLRQ

7R GHWHUPLQH VXLWDEOH PRGHO FDOLEUDWLRQ HYHQWV WKH SHUL
UHIHUHQFHG DJDLQVW LQIRUPDWLRQ UHJDUGLQJ WKH SDVVDJH RI W
REWDLQHG IURP WKH %XUHDX RI 0HWHRURORJ\ %R0 F\FORQH GDWDE
WKH F\FORQHV WKDW FDPH ZLWKLQ DURXQG NP RI 3RLQW 0RRUH
QRWHG WKDW WKH F\FORQH UHFRUG KDV EHHQ FRQVLGHUHG VXVSHFW
SULRU WR WKLV SHULRG ZDWHU OHYHO UHFRUGV DW *HUDOGWRQ 3

*LYHQ WKH LQIRUPDWLRQ DERYH WZR VHSDUDWH HYHQWV ZHUH FK
RI WKH 'HOIW ' PRGHOZHUH VHOHFWHG WR EH XVHG DV WKH EDVLV
VXUJH DQG DOVR KDG JRRG GDWD FRYHUDJH ZLWKLQ WKH KLVWRUL
UHFRUG 7KH FKRVHQ HYHQWV DUH DV IROORZV

7& 9LQFHQW IRU FDOLEUDWLRQ DQG YDOLGDWLRQ ZLWK WKH RE
3RUW

)LJXUH 7UDFNV 6HYHULW\ 3ORW IRU 7& 9LQFHQW

7KH UHVXOW RI WKH PRGHOOLQJ RI 7& %LDVDVVHVVHGLQWKHLQ
SUHYLRXV SDUDJUDSK WKH PRGHOOLQJ ZDV FRPSOHWHG IRU WKH
GDWDEDVH 1HYHUWKHOHVV WKH PHDVXUHG DQG PRGHOOHG ZDWH
WKH PHDVXUHG DQG PRGHOOHG VXUJH OHYHOV ZLWK WKH PRGHO
OHYHO DQG VXUJH WR DQ DFFXUDF\HWWKLVWKLQ OHYHO RI DFF
PRGHOOLQJ RI ZDWHU OHYHO GXULQJ WKH SDVVDJH RI 7& %LDQFD
RI DJUHHPHQW EHWZHHQ WKH REVHUYHG DQG SUHGLFWHG ZDWHU
DJDLQ UHSUHVHQWV D YHU\ FORVH DJUHHPHQW EHWZHHQ WKH
SURYLGHV FRQILGHQFH LQ WKH PRGHO DV D UHOLDEOH SUHGLFWLY

&\FORQH *HQH
'HWHUPLQLQJ F\FORQH
ORFDWLRQ

3URSDJDWLRQ 3I
'HWHUPLQH F\FORQH
SURSDJDWLRQ S

6WRUH WKH
3DUDPHWH

)LJXUH 0RQWH &DUOR 6LPXODWLRQ 6FKHPH

+LVWRULFDO 'DWD $QDO\VLV

%R0 PDLQWDLQV D F\FORQH GDWDEDVH WKDW FRQWDLQV LQIRUPDW
H[SHULHQFHG EHWZHHQ DQG IRU WKH $XVWUDOLDQ UHJLRQ
LQFOXGHV LQIRUPDWLRQ VXFK DV F\FORQH ORFDWLRQ FHQWUDO S
UHOHYDQW F\FORQH WUDFN SDUDPHWHUV +RZHYHU DV SUHYLRXVO
WKH UDZ F\FORQH GDWDEDVH ZDV ILOWHUHG WR LQFOXGH RQO\ GD

$QDO\VLV RI WKH KLVWRULFDO F\FORQH GDWDEDVH ZDV FRPSOHWHG
WHPSRUDO FKDQJHV LQ WKH NH\ SDUDPHWHUV UHTXLUHG IRU F\FOR
NH\ SDUDPHWHUV LQFOXGH WKH IROORZLQJ

/RFDWLRQ RI RULJLQ UHIHU WR DV WKH F\FORQH JHQHVLV ORFD

)RUZDUG VSHHG RI WKH F\FORQH

&\FORQH GLUHFWLRQ KHDGLQJ

&HQWUDO SUHVVXUH

6WDWLVWLFDO GLVWULEXWLRQV IRU HDFK RI WKH NH\ SDUDPHWHUV
ORQJLWXGH JULG FRYHULQJ WKH ZKROH RI WKH $XVWUDOLDQ UHJLF
IRU HDFK JULG LQ RUGHU WR HQVXUH WKDW VSDWLDO YDULDWLRQV
ZHUH FDSWXUHG ZLWKLQ WKH PRGHO

&\FORQH *HQHVLV /RFDWLRQ

:LWKLQ WKH 0&0& PRGHO F\FORQH JHQHVLV SRVLWLRQV DUH REWD
SDUDPHWULF SUREDELOLW\ GLVWULEXWLRQ ,Q RUGHU WR FUHDWH
KLVWRULFDO F\FORQH GDWDEDVH ZDV ILOWHUHG WR LQFOXGH RQO\
F\FORQH 7KH ILOWHUHG JHQHVLV LQIRUPDWLRQ ZDV WKHQ VPRRWK
LQ RUGHU WR HQVXUH D FRQWLQXDO FRYHUDJH RYHU WKH HQWLUH
GLVWULEXWLRQ IRU F\FORQH JHQHVLV LV, WKURXJKRXW)LJXUH WKD
GDWD UHODWHV RQO\ WR F\FORQH JHQHVLV ZLWKLQ WKH $XVWUDOLDQ
ZDV FRQILQHG WR HQVXUH WKDW F\FORQH JHQHVLV FRXOG QRW RFF

)LJXUH 6PRRWKHQHG *HQHVLV 3UREDELOLW\ 'LVWULEXWLRQ

)LJXUH 6PRRWKHQHG *HQHVLV 3UREDELOLW\ 'LVWULEXWLRQ

,Q RUGHU WR HVWDEOLVK D F\FORQH JHQHVLV SRVLWLRQ IRU HDFK JHQHVLV ORFDWLRQ ZDV VDPSOHG IURP WKH JHQHVLV SUREDELOLW

3UHYLRXV 5DWH RI &KDQJH RI 6SHHG

7KH UDWH RI FKDQJH RI IRUZDUG VSHHG RI D F\FORQH PD\ QRW EH F\FORQH FRXOG EH DFFHOHUDWLQJ DW WKH SUHYLRXV ORFDWLRQ 7KHUHIRUH LW LV HVVHQWLDO WKDW WKH SUHYLRXV UDWH RI FKDQ GHWHUPLQLQJ WKH FXUUHQW UDWH RI FKDQJH RI IRUZDUG VSHHG

5DWH RI &KDQJH RI 'LUHFWLRQ

7KH UDWH RI FKDQJH RI GLUHFWLRQ LV XVHG WR SUHGLFW WKH SUF DQWLFLSDWHG WKDW RYHU D ORQJ WHUP UHFRUG WKHUH LV D YHU\ SUHYLRXV GLUHFWLRQ WKHUHIRUH LW LV EHOLHYHG WKDW WKH UD DSSURSULDWH SUHGLFWRU IRU GLUHFWLRQ

3UHYLRXV 5DWH RI &KDQJH RI &HQWUDO 3UHVVXUH

7R SUHGLFW WKH FHQWUDO SUHVVXUH DW D VSHFLILHG ORFDWLRQ PRUH FRQWLQXRXV UDWH RI FKDQJH RI FHQWUDO SUHVVXUH DV D S LQWHQVLI\ GLVVLSDWH EDVHG RQ D SUHYLRXV UDWH RI FKDQJH W LQFUHDVHV LQ SUHVVXUH GXULQJ WKH LQWHQVLILFDWLRQ RI D F\FO

3URSDJDWLRQ 3UREDELOLW\ 6XUIDFHV

2QFH WKH SUHGLFWRUV ZHUH GHWHUPLQHG SUREDELOLW\ VXUIDFH VXUIDFHV JHQHUDWHG DUH DV IROORZ

5DWH RI FKDQJH RI VSHHG YHUVXV SUHYLRXV UDWH RI FKDQJH I

5DWH RI FKDQJH RI GLUHFWLRQ YHUVXV GLUHFWLRQ

5DWH RI FKDQJH RI FHQWUDO SUHVVXUH YHUVXV SUHYLRXV UDW

$Q H[DPSOH RI WKH SUREDELOLW\ VXUIDFHV JHQHUDWHG IRU UDWH DW RQH J"B RI H

ÀRQ RQ L @ XV

7UDFN 5DQNLQJ

,Q RUGHU WR UDQN WKH V\QWKHVLVHG F\FORQH HYHQWV EDVHG RQ
VWXG\ VLWH WKH F\FORQLF VWRUP VXUJH FRPELQHG ZLWK WKH SU

$ SDUDPHWULF FDOFXODWLRQ RI OLNHO\ VWRUP VXUJH KDV EHHQ L
WR SURYLGH SUHGLFWLRQV RI WKH SRWHQWLDO VWRUP VXUJH DW V
FDOFXODWLRQ LV EDVHG RQ WKUHH F\FORQH SDUDPHWHUV WKLV L
EDURPHWULF SUHVVXUH GHSUHVVLRQ WKH F\FORQH DQG WKH GLVWDQFH

7R HVWLPDWH WKH WRWDO ZDWHU OHYHO DW WKH VLWH WKH DVWU
WKH SDUDPHWULF FDOFXODWLRQ RI WKH VWRUP VXUJH 7KH WLGDO
RI WKH F\FORQH LV FDOFXODWHG XVLQJ D KDUPRQLF DQDO\VLV /XL
DGRSWHG

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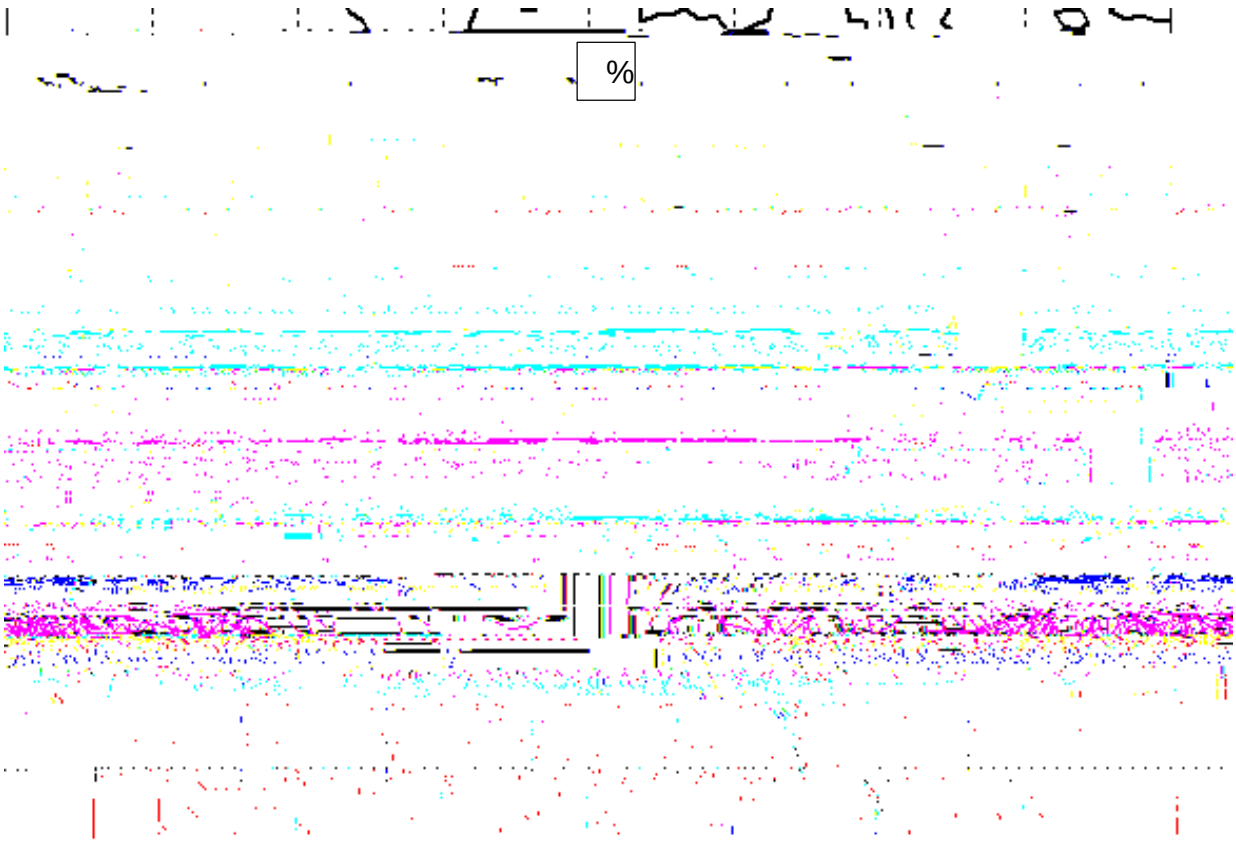

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% 0RGHOOHG F\FORQH WUDFNV IRU WKH VDPH SHUL

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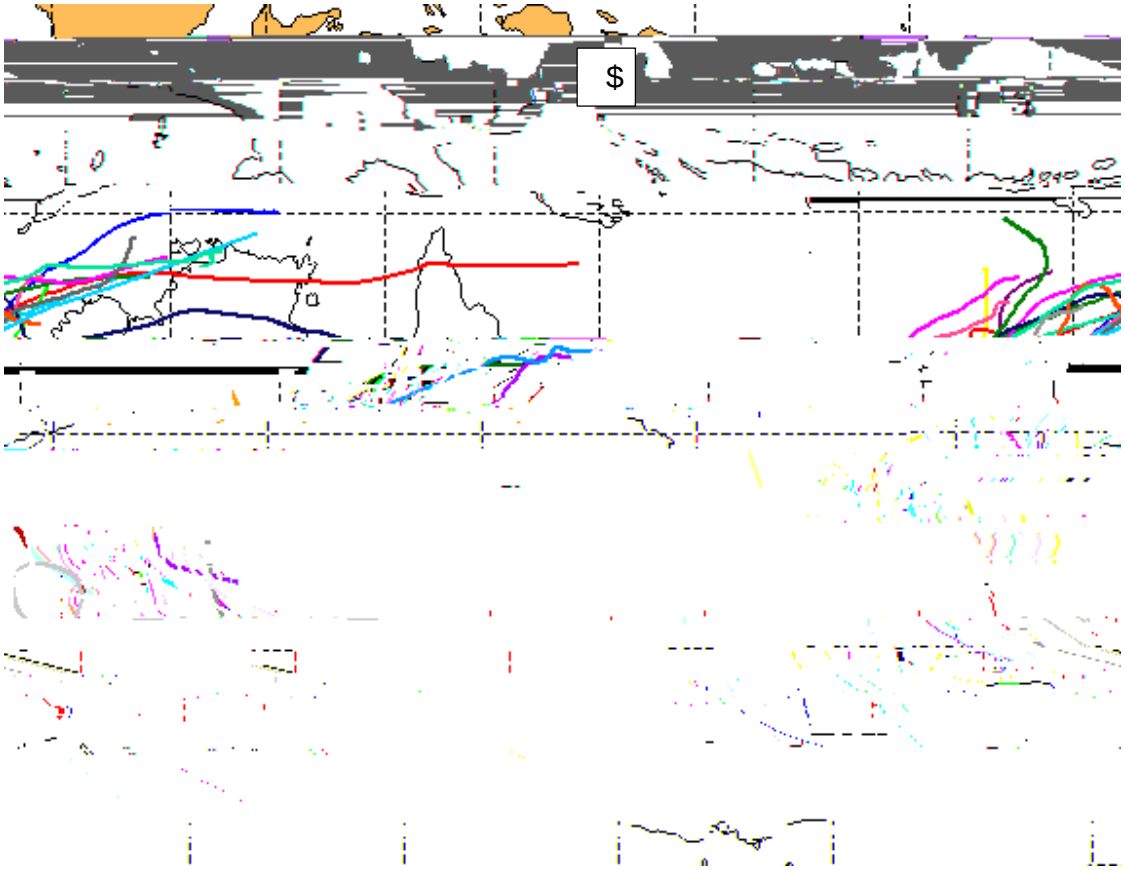
. 5HSRUW 5 5HY 3DJH



)LJXUH $ +LVWRULFDO F\FORQH WUDFNV DIIHFWLQJ *HUDOG
% 0RGHOOHG F\FORQH WUDFNV DIIHFWLQJ *HUDOGW

u ‰ Œ}P Œ• ˜ ••}] š • ‰&0* 3RLQW 0RRUH ,QXQGDWLRQ &RDVWDO 3
. 5HSRUW 5 5HY 3DJH

)LJXUH 'HOIW ' 2XWSXW SORW VKRZLQJ D W\SLFDO F\FORQH
WUDFNLQJ WR WKH HDVW RI 3RLQW 0RRUH

)LJXUH 6HSDUDWLRQ RI ,QGLYLGXDO +LJK :DWHU /HYHO (YHQ

$V LOOXVWUDWHG ZLWK WKH ER[DUH FRQVLGHUHG DQG ZHUH QRW LQFOXGHG LQ WKH DQDO\VLV 7KH QH[W ZDWHU OHYHO ODWHU RU HDUOLHU ZKLFK LV ORFDWHG RXWVLGH WKH ER[LQ WK

([WUHPH $QDO\VLV

$Q H[WUHPH DQDO\VLV ZDV VXEVHTXHQWO\ FRPSOHWHG RQ WKH ILQ SDUW RI WKLV SURFHVV LW ZDV QRWHG WKDW HYHQWV IURP WKH UHSUHVHQWHG ZLWKLQ WKH OLVW RI KLJKHVW REVHUYHG ZDWHU OH FRPLQJ IURP WKLV SHULRG 8SRQ IXUWKHU UHYLHZ RI WKH GDWD L UHFRUGLQJ LV WRR FRDUVH WR DGHTXDWHO\ FDSWXUH WKH SHDN R H[WUHPH DQDO\VLV ZRXOG WKHUHIRUH UHVXOW LQ HUURQHRXVO\ O KRXUO\ GDWD IURP WR ZDV H[FOXGHG IURP WKH DVVHVVPH DQG

7VXQDPL ,QGXFHG ,QXQGDWLRQ $VVHVVPHQW

7KH :HVWHUQ $XVWUDOLDQ FRDVWOLQH H[SHULHQFHV D UHODWLYHO
SULPDULO\ GXH WR LWV SUR[LPLW\ WR WKH]RQH RI WHFWRQLF DFW
VRXWKHUQ HGJH RI WKH ,QGRQHVLDQ DUF KLJKHVW VHLVPLFLW\ RFFXUV DORQJ
SUHSDUHG SHU RXWOLQLQJ WKH UHVXOWV RI D SUREDELOLVWLF WVX
$XVWUDOLD FRPSOHWHG LQ 7KH UHVXOW RI WKLV DVVHVVPHQW
KLJKHVW DORQJ WKH FRDVW IURP &DUQDUYRQ WR 'DPSLHU ZKLOH
RI 6KDUN %D\

1HYHUWKHOHVV 633 UHTXLUHV WKDW DQ DOORZDQFH IRU DEVRU
DGRSWHG RQ PD[LPXP LQXQGDWLRQ KHLJKWV HYDOXDWHG LQ WVX
LQWHUURJDWLRQ RI WKH ZDWHU OHYHO UHFRUGV WKH PD[LPXP WV
*HUDOGWRQ UHJLRQ SUHGLFWHG GXULQJ WKH ,QGLDQ 2FHDQ 7VXQDPL RQ

+RUVSRRO HW DO LQYHVWLJDWHG WKH LPSDFW RI WKH ,QGL
WVXQDPL VLJQDO DIWHU WKH UHPRYDO RI WKH WLGDO IOXFWXDWLO
SUHVHQWHG LQ WKH IROORZLQJ)LQGKRUQ7KLPXXP\ZDWHUPDUN
DURXQG P

)LJXUH 'HFHPEHU 7VXQDPL 6LJQDO 6RXUFH *HRVFLHQFH

7R HQDEOH HVWLPDWLRQ RI WKH UHFXUUHQFH LQWHUYDO RI WVXQD
FRPSOHWHG WVXQDPL KD]DUG DVVHVVPHQWV KDV EHHQ UHYLHZHG DV
GHSWK WR WKH WVXQDPL UHFXUUHQFH LQWHUYDO $ QXPEHU RI KD
RHV[RQDH0DVD` [RQ $ Q!DP $ D$"H (€

UHDVRQDEOH WR SURYLGH QR DGGLWLRQDO DOORZDQFH WR DEVRU
LQXQGDWLRQ

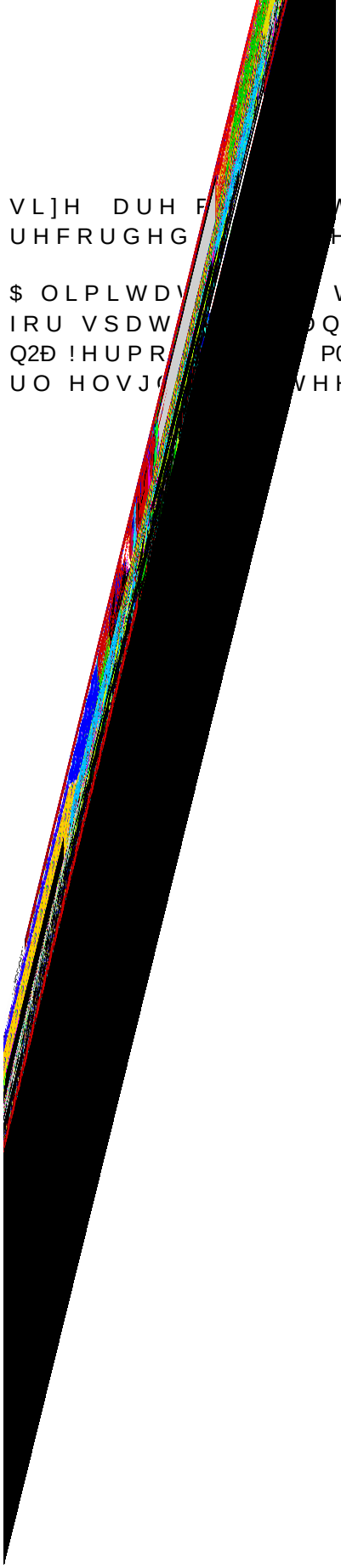
&RDVWDO 3URFHVVHV $OORZDQFHV

$FXWH 6WRUP (URVLRQ $OORZDQFH

6HYHUH VWRUP HYHQWV KDYH WKH SRWHQWLDO WR FDXVH LQFUHDV
FRPELQDWLRQ RI KLJKHU VWHHSHU ZDYHV JHQHUDWHG E\ VXVWDLQ
OHYHOV 7KHVH WZR IDFWRUV DFWLQJ LQ FRQFHUW DOORZ ZDYHV
QRUPDOO\ YXOQHUDEOH WR ZDYH DWWDFN

,I WKH LQLWLDO UHVSRQVH LV LQVXIILFLHQW WR GLVVLSDWH WKH LQF
HQHUJ\ LV IWHQ VSHQW HURGLQJ WKH EHDFK IDFH EHDFK EHUP D
VDQG LV WUDQVSRUP2Ð ðH RUÁiH HUUPPG pV XSXSSHUG SG FHP
OH D

633 UHFRPPHQGHG DOORZDQFH IRU DEVRUELQJ DFXWH HURVLRQ E
FUHGLEOH VHGLPHQW WUDQVSRUW PRGHO :$3& 7KH PRGHO VK
SRWHQWLDO VKRUHOLQH HURVLRQ UHVXOWLQJ IURP D VWRUP HYHQ
SUREDELOLW\ $L(3 HTXLYDOHQW WR D \HDU $YHUDJH, HVXUUHQFH
JHQHUDOO\ DFFHSWHG WKDW VLPXODWLRQ RI WKUHH UHSHDWV RI D
DORQJ WKH VRXWK ZHVW RI :HVWHUQ $XVWUDOLD LQ -XO\ SURY
WKH \HDU $5, HYHQW IRU7KLVDWRUHURGLRQOHYDWHG ZDWHU OHY
DSSUR[LPDWHO\ KRXUV DQG FDXVH!U OHYRX •W 0 DXWB` KR

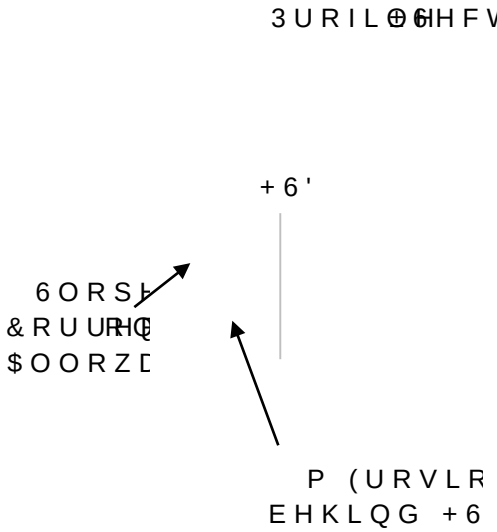


VL]H DUH F WO\ DSSOLHG DQG FDUH LV WDNHQ WR HQVXUH W
UHFRUGHG HLJKWV DQG ZDWHU OHYHOV

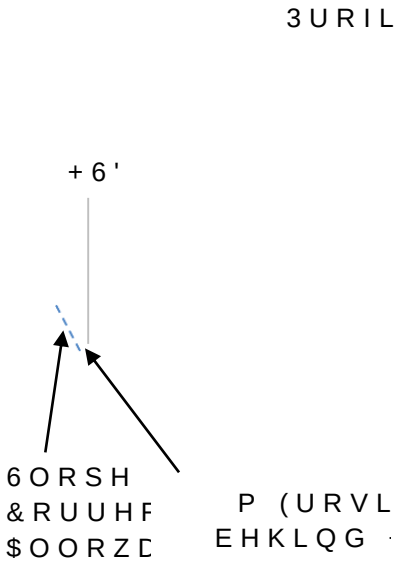
$ OLPLWDW WKH 6%($&+ PRGHO LV WKDW LW LV D VLQJOH SU
IRU VSDW QJHV RI ZDYHV DQG ZDWHU OHYHOV RYHU FRPSOH
Q2Đ !HUPR P0 ^ pHU OHYHOV RYHU FR • PHPH"FKW
UO HOVJ WHH J @HH pH° PRpH!D `JO HO@H•WH' O FR ` •WHpK

VWRUP 7KH EHDFK ZDV GLYLGHG LQWR WKHVH VHFWRUV EDVHG RQ
FKDUDFWHULVWLFV RI WKH EHDFKHV DORQJ WKH VWXG\ DUHD DV V
FRPSLOHG IURP K\GURJUDSKLFDO VXUYH\ SODQV DQG DYDLODEOH W

7KH ZDWHU OHYHOV IRU WKH -XO\ VWRUP ZHUH UHFRUGHG E\ '3,
$XVWUDOLD DQG DUH UHSUHVHQWDWLYH RI WKH ZDWHU OHYHOV H[S
GHSWK 7KHVH ZDWHU OHYHOV SHDN DW DURXQG 'HFHPEHU DQG
DURXQG WR \HDUV IRU)UHPDQWOH 7KH ZDWHU OHYHO UHFRUG
WKDW WKH ZDWHU OHYHO IRU D VLPLODU UHWXUQ SHULRG LV DUR
UHFRUGHG GXULQJ WKH -XO\ VWRUP HYHQW EHFDXVH EQ WKH 6
R €%LTS DDHKI € SHDUVKRUH EDWH RRUG QKRQ RRP WKH *XO\
TD1 '!E DC @ ° ‘ H G €S H J H U W H U 1À yg H Z R `· R H 0 W R p L D W H



)LJXUH 6%($&+ 6LPXODWLRQ 5HVXOWV 3URILOH



)LJXUH 6%($&+ 6LPXODWLRQ 5HVXOWV 3URILOH

)LJXUH 2EOLTXH $HULDO 3KRWRJUDSKV RI 3RLQW 0RRUH

u ‰ Œ}P Œ• ˜ ••}] š • ‰&0* 3RLQW 0RRUH ,QXQGDWLRQ &RDVWDO 3
. 5HSRUW 5 5HY 3DJH

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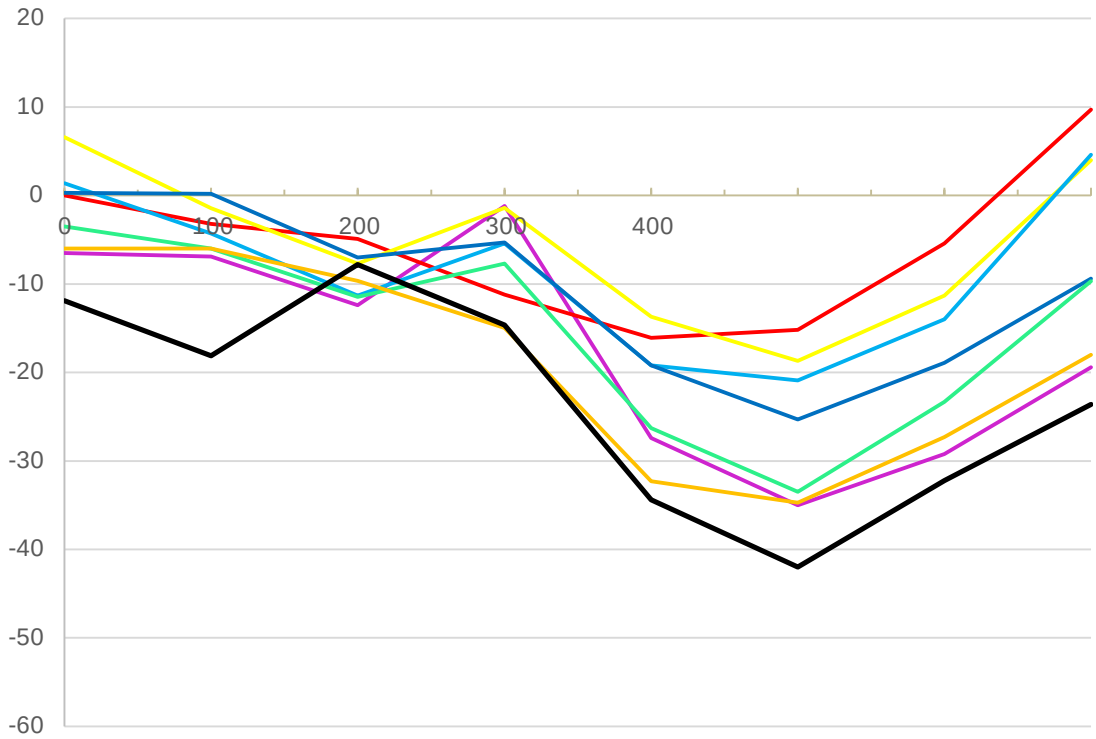

)LJXUH 6KRUHOLQH 0RYHPHQW 3ORWV IRU 6HFWRU ± 3RLQW

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. 5HSRUW 5 5HY 3DJH

)LJXUH 6KRUHOLQH 0RYHPHQW 3ORWV IRU 6HFWRU ± 3RLQ

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. 5HSRUW 5 5HY 3DJH

)LJXUH 6HGLPHQW 3DWKZD\V LQ WKH *HUDOGWRQ &RDVWDO 8QLYHUVLW\

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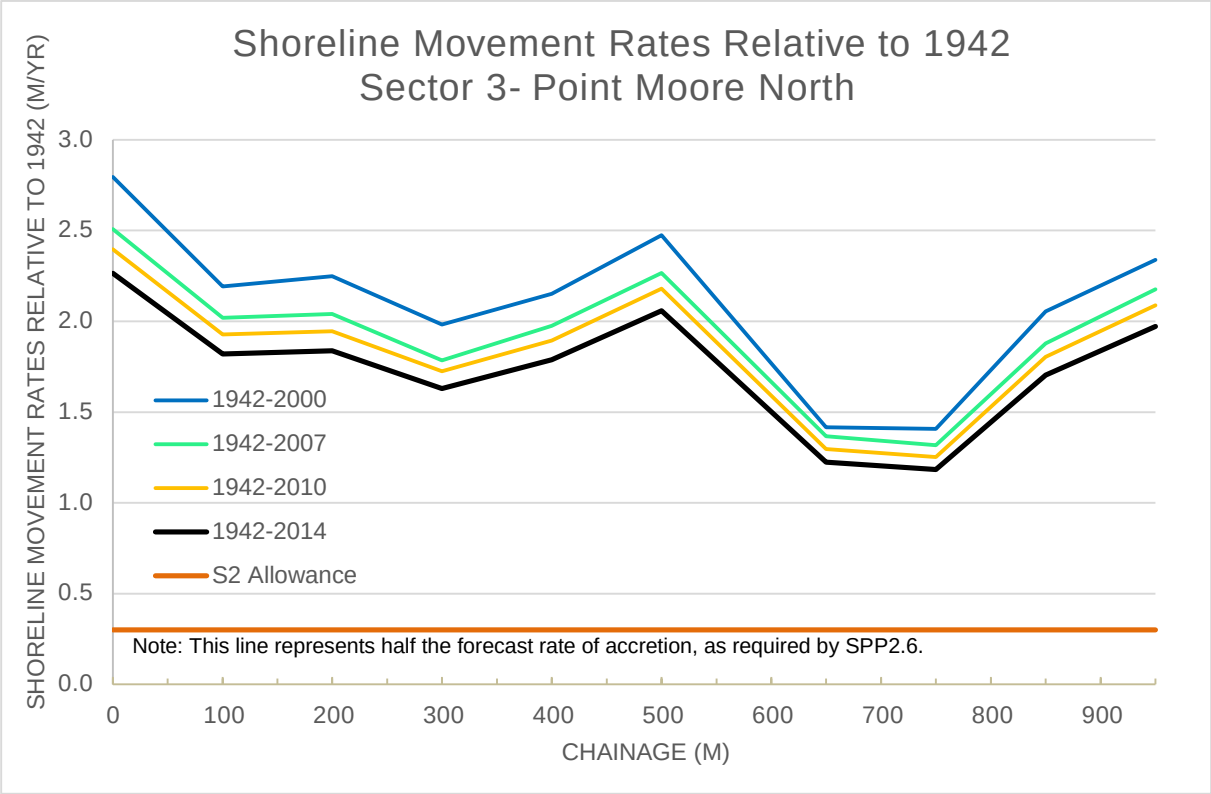
. 5HSRUW 5 5HY 3DJH



)LJXUH /RQJ 7HUP 6KRUHOLQH 0RYHPHQW 5DWHV WKH 6 $O

6HD /HYHO 5LVH $OORZDQFH 6

7KH HIIHFW RI VHD OHYHO ULVH RQ WKH FRDVWDO UHJLRQV GLHIIHUV GHSHQGLQJ RQ WKH WUHDWPHQW IRU VDQG\ VKRUHV LQFOXGLQJ H[DPLQDWLRQ RI WKH 5XOH UHODWHV WKH UHFHVVLRQ RI WKH VKRUHOLQH WR WKH VHD OHYHO VHGLPHQW EHG

$$R \quad \frac{1}{\tan(\ )} S$$

ZKHUH 5 UHFHVVLRQ RI WKH VKRUH

DYHUDJH VORSH RI WKH QHDUVKRUH VHGLPHQW EHG DQG

6 VHD OHYHO ULVH

.RPDU VXJJHVWV WKDW WKH XVXDO UDQJH RI UHFHVVLRQ LV 5 6 GRHV QRW WDNH LQWR DFFRXQW SRVVLEOH FKDQJHV LQ WKH EDODQFH RI VHGLPHQW LQ UHVSRQVH WR 6HD OHYHO ULVH DQG WKDW IRU VDQG\ VKRUHV WKH UHFHVVLRQ EH WDNHQ DV WKH HVWLPDWHG VHD OHYHO ULVH

%DVHG RQ VHD OHYHO ULVH DGRSWHG LQ 7DEOH WKH DOORZDQFH IRU WKH WKUHH NH\ WLPH IUDPHV DQG LV SUHVHQWHG LQ 7

7DEOH 6HD /HYHO 5LVH $OORZDQFH 6

7LPHIUDPH	6 $OORZDQFH

,W VKRXOG EH QRWHG WKDW WKH DOORZDQFH SURYLGHG LQ WKLV WDEOH DOORZDQFHV IRU EH FRPSOHWHG EDVHG RQ D \HDU SODQQLQJ KRUL]RQ 7KHUHIRUH P KDV EHHQ DGRSWHG IRU *LYHQ WKH 6 YDOXH WKH SRV 0RRUH VKRUHOLQH WKDW FRXOG RFFXU DV D UHVXOW 7KLV LV LQFUH OHYHO \ WR EH FRQVHUYDWLYH UDWKHU WKDQ EHLQJ EHHI

7RWDO &RDVWDO 3URFHVVHV $OORZDQFH

7KH WRWDO UHFRPPHQGHG DOORZDQFH IRU WKH IXWXUH DFWLRQ RI DOORZDQFHV GHWHUPLQHG LQ SUHYLRXV VHFWLRQV RI WKLV UHSRUW DQG DGMXVWHG WR UHIOHFW FXUUHQW \HDU VKRUHOLQH FRQGLWLRQV DQG SURMHFWHG 6HSWHPEHU UHFRPPHQGHG FRDVWDO SURWHFWLRQ SURMHFWV RQ WKH SULRULWL]HG OLVW DQG DUH SUHVHQWHG LQ 7DEOHV WR

7DEOH 7RWDO 5HFRPPHQGHG &RDVWDO 3URFHVVHV $OORZDQ

6HFWR	6 P	6 P	6 P	$OORZD IRU 8QFHUW P	7RWD $OØØRQ P

7DEOH

u ‰ Œ } P Œ • ˜ • • }] š • ‰&0 *

5HIHUHQFHV

%UXXQ 3 ³6HD OHYHO ULVH DV D FDXVH RI VKRUH HURVLRQ ´ 'LYLVLRQ $PHULFDQ 6RFLHW\ RI &LYLO (QJLQHHUV ::,

%XUELGJH&XPPL5Q3V 0OHF]NR7KLR+. $ 3UREDELOLVWLF 7VXQDPL +D] $VVHVVPHQW IRU :HVW3XUE 6DQGW$SSOLHG *HRSK\VLFV

%XUHDX RI 0HWHRURORJ\ 7RKRSXVWUDOLDQ 7URSLFDO&\FORQH DDWDEDVH KWWS ZZZ ERP JRY DX F\FORQH@QGH[VKWPO

&(5& 6KRUH 3URWHFWLRQ &RQVWUXFWLRQ (QJLQHHULQJ 5HVHDUFK &HQWUH (QJLQHHUV 9LFNVEXUJ 06

&RUW - : 6FRWW 0 5 6HDZDOO &RPPXQLW\ &RQVLGHUDWLRQV LQGH[RI PRGHO SHUIRUPDQFH LQWHUQDWLRQDO -RXUQDO RI &OLPDWRORJ\

'DPDUD :$ 7KH &RDVW RI WKH 6KLUHV RI &RRURZ WR 1RUWKDPSWR $XVWUDOLD *HRORJ\ *HRPRUSKRORJ\ DQG 5HOLHI 3URFHHGLQJV RI 3

*O R V V D U \

µ D F F U H W L R Q ¶ V W R V K R U H O L Q H P R Y H P H Q W Z K H U H W K H V K R U H O L Q H V
R I D F R D V W D O I R U H V K R U H U H V H U Y H D Q G R U W K H G L V W D Q F H W R D I

µ D Q Q X D O U H F X U U H Q F H Y D O X ¶ D J H R U H [S H F W H G Y D O X H R I W K
H [F H H G D Q F H V R I D J L Y H Q H Y H Q W R Y H U D J L Y H Q G X U D W L R Q

µ F R D V W D O I R U H V K R U H U H V H U Y H ¶ I O D Q G R Q W K H F R D V W V H W D V L G H

$SSHQGLFHV

$SSHQGL['$XQH ,QXQGDWLRQ $VVHVVPHQW 3ODQ
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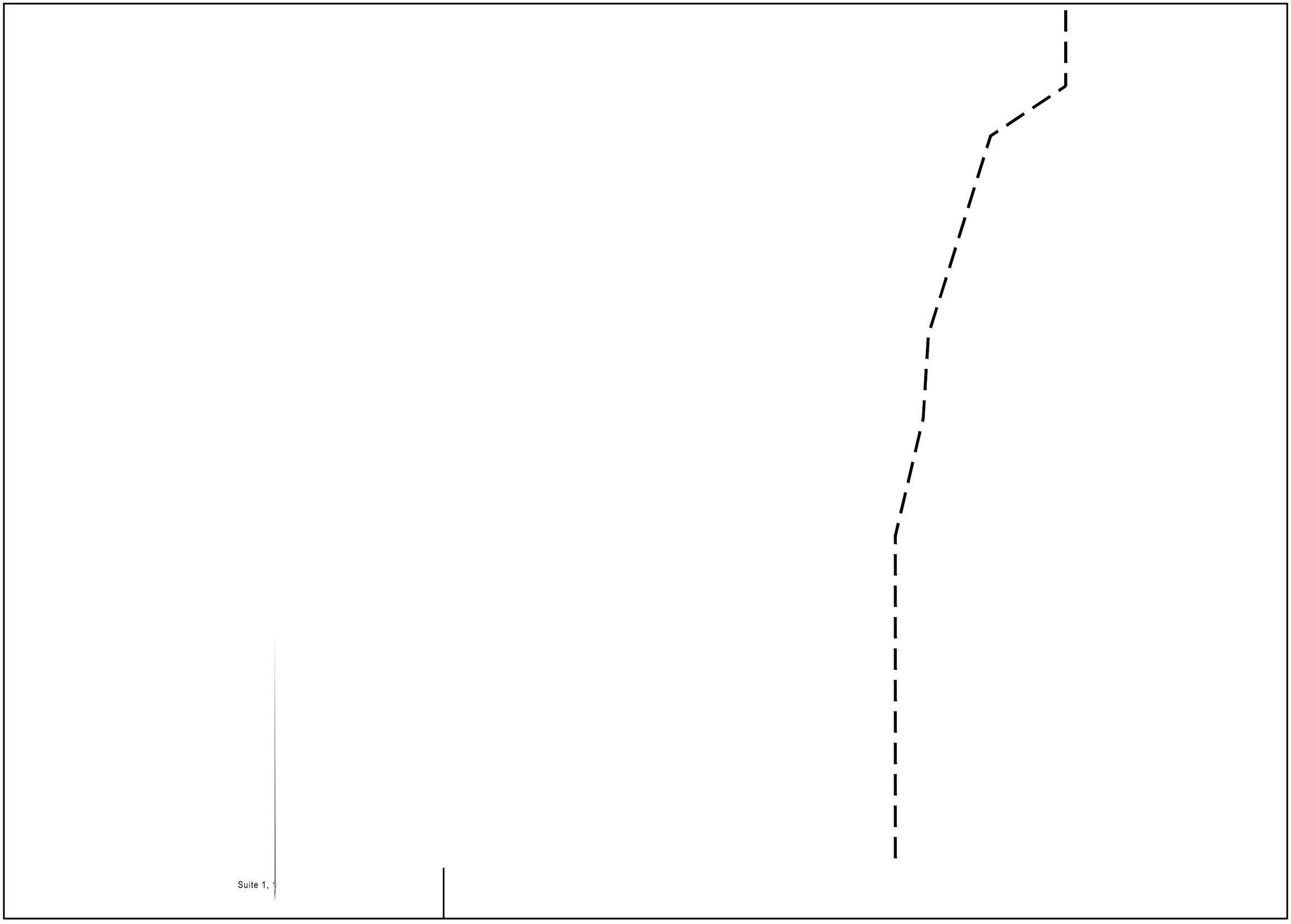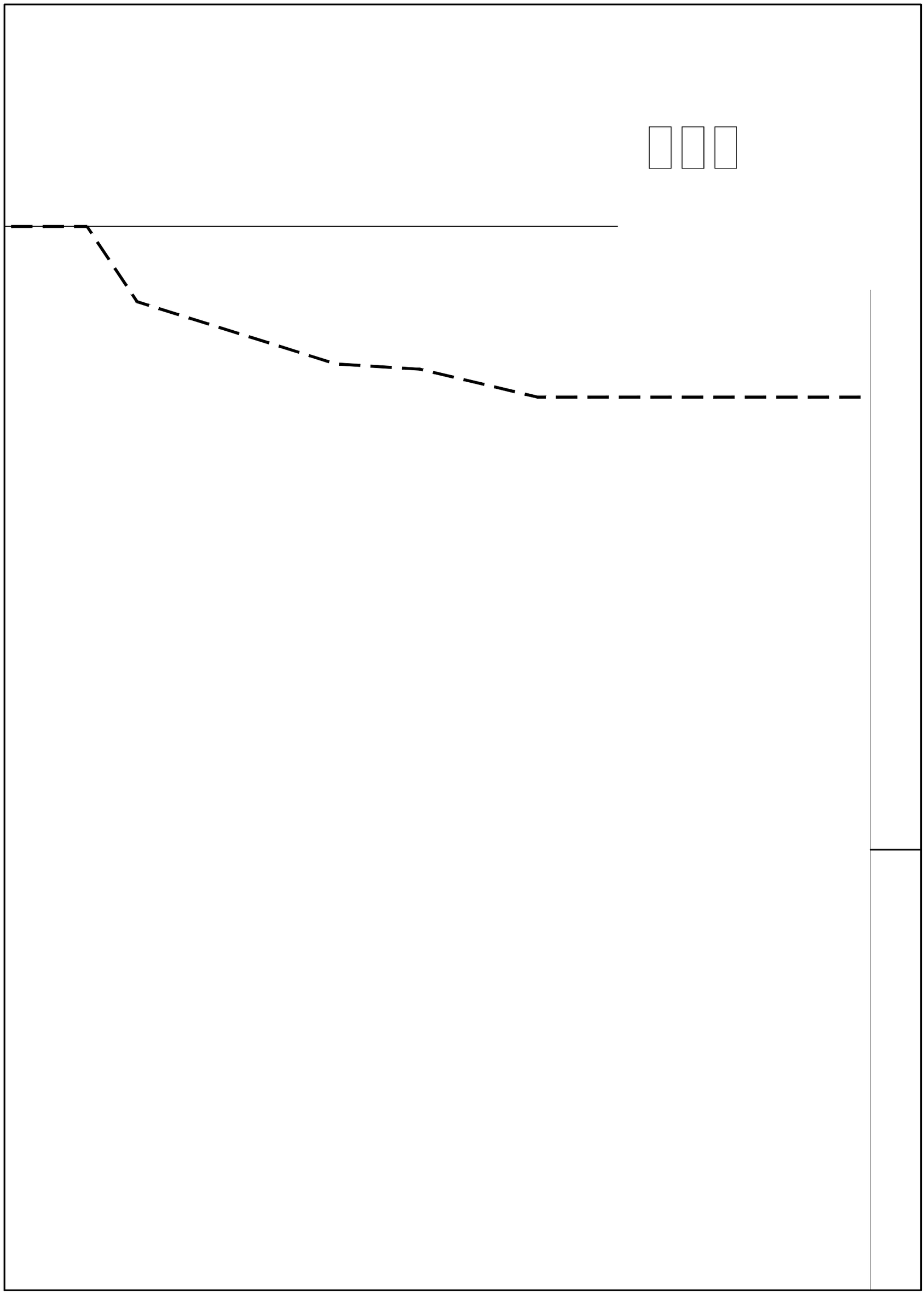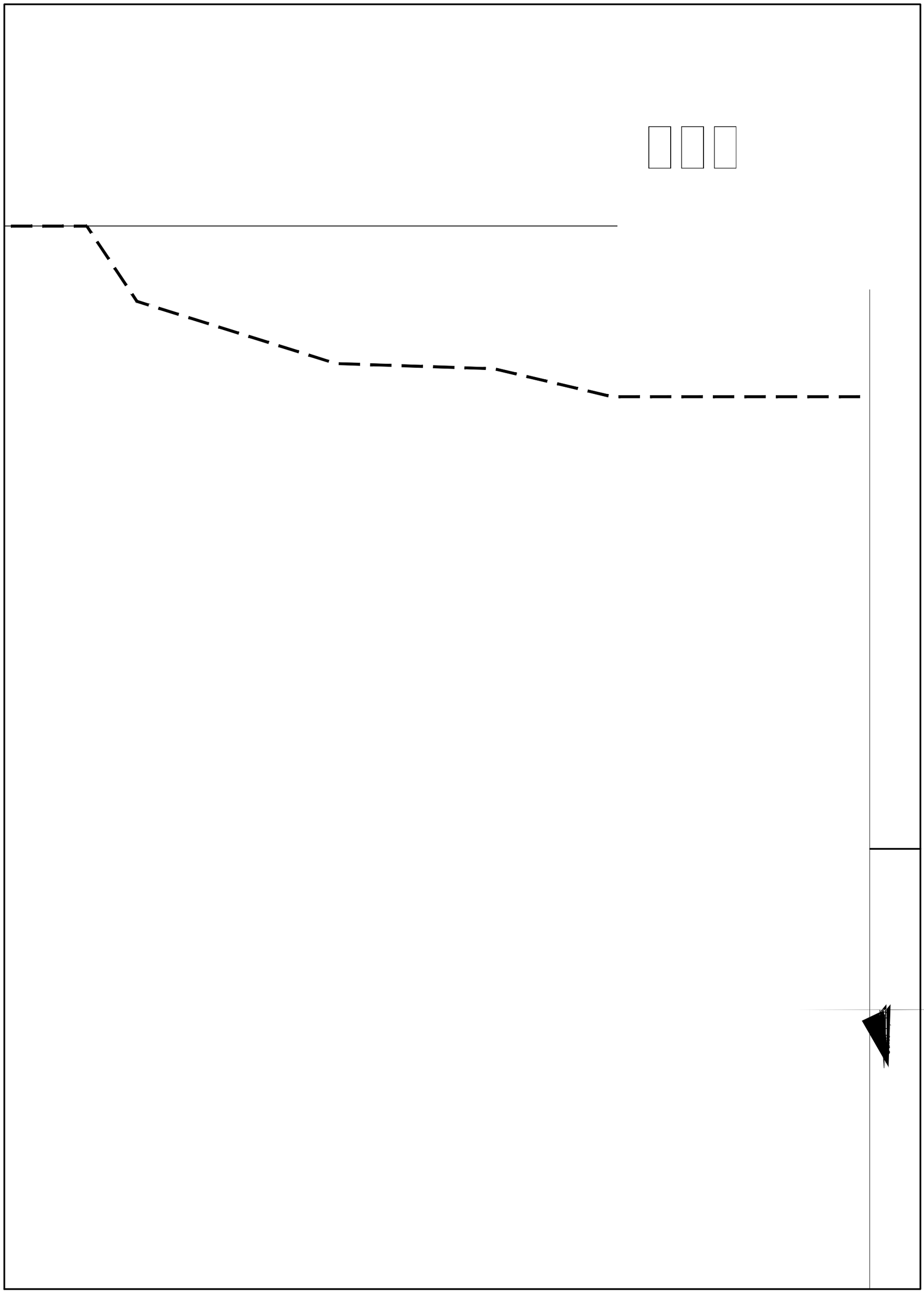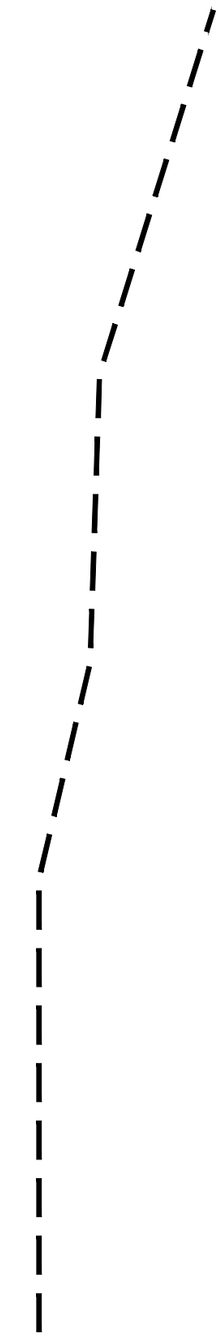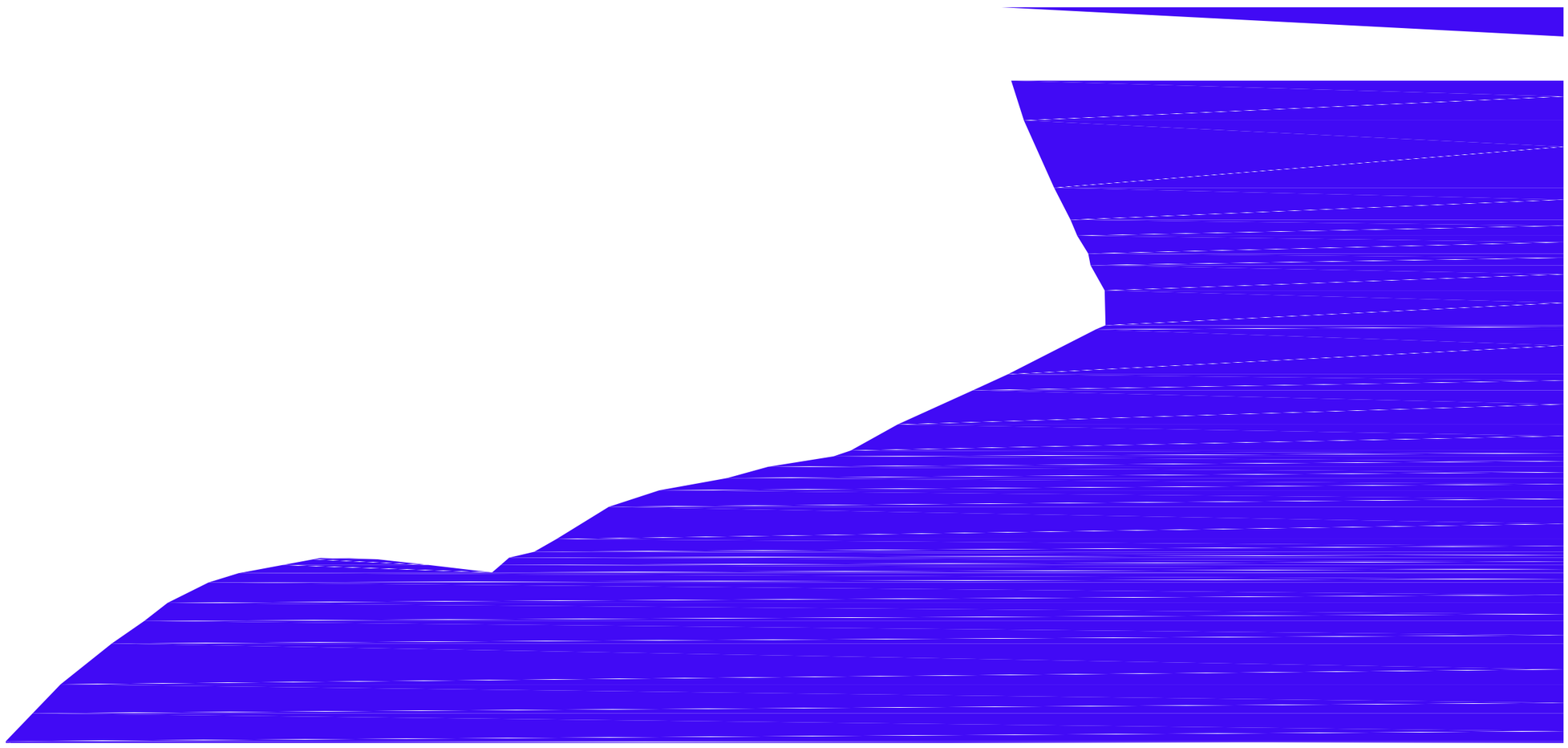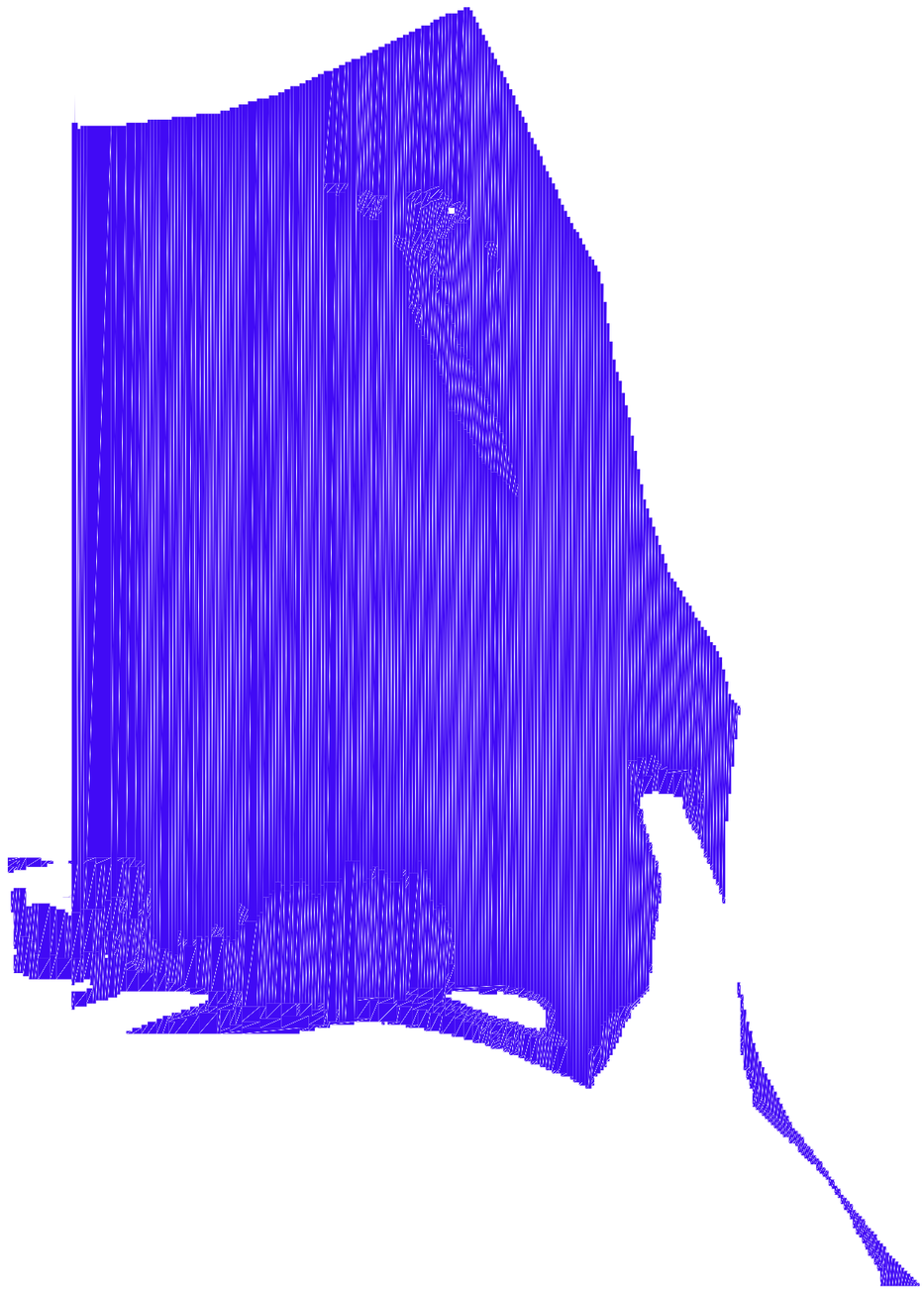
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