

!"#&/

4;O <548G=>3> 70AB>AC20==O ;V:0@AL:>3> 70A>1C

"

(CONTRIVEN)

C:;04:

4VNG0 @5G>28=0: 0?@>B8=V=;

1 <; @>7G8=C B8=V=C;

4>?>28=8: =0B@VN E;>@84, 2>40 4;O V=T:FV9.

V:0@AL:0 D>@<0. >7G8= 4;O V=T:FV9.

A=>2=V DV78:>-EVABV: ?@>7>@0, 15710@2=0 01> 7 6>2BC20B8< 2V4BV=:>< @V48=0.

\$0@<0:>B5@0?52B8G=0 3@C?0. =3V1VB>@8 ?@>B5W=07. ?@>B8=V=. >4 ""% 0201.

\$0@<0:>;>3VG=V 2;0AB82>ABV.

\$0@<0:>48=0

?@>B8=V= ?@54AB02;OT A>1>N <>;5:C;C V=3V1VB>@0 ?@>B507 H8@>:>3> A?5:B@0 4VW, 2>;>4VT 0=B8DV1@8=>;VB8G=>N 0:B82=VABN. #B2>@NNG8 >1>@>B=89 AB5EV<5B@8G=89 :>@, 0?@>B8=V= C ;N48=8 V=3V1CT B@8?A8=, ?;072V V B:0=8=0E, I> ?@872>48BL 4> V=3V1C20==O DV1@8=>;V7C.

@V< B>3>, 2V= V=3V1CT :>=B0:B=C D07C 0:B820FVW 73>@B0==O :@>2V, O:0 T D0:B>@< 70?CA:C ?@>F5AC :>03C;OFVW V AB8;V7C.

?@>B8=V= 70AB>A>2CTBLAO ?V4 G0A >?5@0FV9 2 C<>20E HBCG=>3> :@>2>>1V3C, >A:V;L:8 2V=>?>A;01;NT 70?0;L=V @50:FVW, I> ?@872>48BL 4> 7=865==O ?>B@518 C B@0=ADC7VW 0;>35==>W :@>2V B0 7=865==O :@>2>2B@0B8, 0 B0:>6 4> 7<5=H5==O =5>1EV4=>ABV ?>2B>@=>3> 4>A;V465==O A5@54>ABV==O 7 ?@82>4C :@>2>B5GV.

# ?0FVT=BV2, O:8< ?@>2>48;0AO >?5@0FVO 0>@B>:>@>=0@=>3> HC=BC20==O, G0AB>B0 ?V428I5==O @V2=O :@50B8=V=C 2 A8@>20BFV :@>2V =0 0,5 <3/4; ?>@V2=O=> 7 ?>G0B:>28< @V2=5 < 1C;0 4>AB>2V@=> 28I>N C ?0FVT=BV2, O:V >B@8<0;8 ?>2=C 4>7C 0?@>B8=V=C, ?>@V2=O=> 7 3@C?>N ?;0F51>. # 1V;LH>ABV 28?04:V2 ?VA;O>?5@0FV9=5 ?>@CH5==O DC=:FV9 =8@>: =>A8;> >1>@>B=89 E0@0:B5@ V =5 1C;> A5@9>7=8<; G0AB>B0 ?V428I5==O @V2=O A8@>20B:>2>3> :@50B8=V=C ?> 2V4=>H5==N 4> ?>G0B:>2>3> @V2=O =0 2 <3/4; V 1V;LH5 1C;0 >4=0:>2>N C 3@C?V, O:0 >B@8<0;0 ?>2=C 4>7C 0?@>B8=V=C, V 2 3@C?V ?;0F51>.

\$0@<0:>:V=5B8:0.

VA;O 2=CB@VH=L>25==>3> 22545==O 0?@>B8=V= H284:> @>7?>4V;OTBLAO ?> 2AL>70:;VB8==> AB>@V, I> AC?@>2>46CTBLAO H284:8< 7=865==O< :>=F5=B@0FVW 0?@>B8=V=C 2 ?;072V, G0A =0?V2282545==O AB0=>28BL 2V4 0,3 4> 0,7 3>48=8. V7=VH5, 7>:@5<0 G5@57 5 3>48= ?VA;O 22545==O, =0AB0T B5@28BL 2V4 5 4> 10 3>48=.

;0F5=B0, 9<>2V@=>, =5 ?>2=VABN =5?@>=8:=0 4;O 0?@>B8=V=C, ?@>B5 ?5=5B@0FVO, >G5284=>, 2V41C20TBLAO 2:@09 ?>2V;L=>.

V4 G0A >?5@0FVW A5@54=V @V2=>206=V :>=F5=B@0FVW ?@5?0@0BC 2 ?;072V C ?0FVT=BV2, O:V >B@8B8=V= ?V4 G0A >?5@0FVW =0 A5@FV, AB0=>28;8 2V4 175 4> 281 <; ?@8 28:>@8AB0==V B0:>W AE5<8:

2000000 2 O:>ABV ?5@28==>W 4>78 2=CB@VH=L>25==>; 2000000 C @>7G8= ?5@28==>3> 70?>2=5==O =0A>A0 V 500000 =0 3>48=C C 283;04V 157?5@5@2=>W 2=CB@VH=L>25==>W V=DC7VW 2?@>4>26 >?5@0FVW. !5@54=O @V2=>206=0 :>=F5=B@0FVO ?@5?0@0BC 2 ?;072V ?V4 G0A >?5@0FVW ?VA;O 22545==O ?>;>28=8 FVTW 4>78 AB0=>28;0 2V4 110 4> 164 <;. 0=V D0@<0:>:V=5B8G=8E 4>A;V465=L 0?@>B8=V=C C 74>@>28E 4>1@>2>;LFV2, C :0@4V>;>3VG=8E ?0FVT=BV2, O:8< ?@>2>48;0AO >?5@0FVO 2 C<>20E HBCG=>3> :@>2>>1V3C, V C 6V=>., O:8< ?@>2>48;0AO 3VAB5@5:B>B5, I> D0@<0:>:V=5B8G=V ?0@0<5B@8 C 4V0?07>=V 4>7 2V4 50000 4> 2000000 <0NBL ;V=V9=89 E0@0:B5@.

207C20==O 7 1V;:0<8 ?;07<8 :@>2V 1C;> 282G5=> ex vivo. ;87L:> 20 % 0=B8DV1@8=>;VBVG=>W  
0:B82=>ABV 1C;> 7C<>2;5=> =572O70=>N D>@<>N C 1571V;:>2> C 72O7:C 7 1V;:0<8 A8@>20B:8.  
# @V2=>206=V9 D07V >1A03 @>7?>4V;C AB0=>282 1;87L:> 20 ;VB@V2, 0 7030;L=89 ;;V@5=A 7  
>@30=V7282 1;87L:> 40 <; =0 E28;8=C.  
?@>B8=V= =0:>?8GC202AO C =8@:0E V <5=H>N N C E@OI>2V9 B:0=8=V.  
0:>?8G5==O ?@5?0@0BC C =8@:0E T @57C;LB0B<< 72O7C20==O 0?@>B8=V=C 7V IVB:>2>N >1;ON  
5?VB5;V0;L=8E ;;VB8= ?@>:A8<0;L=8E :0=0;LFBV2, 0 B0:>6 :C;V7>A><0E F8E ;;VB8=. C  
V=H8E >@30=0E :>=F5=B@0FVO ?@5?0@0BC 2 >A=>2=>20BFV :@>2V. 09<5=H0 :>=F5=B@0FVO  
?@5?0@0BC A?>AB5@V30;0AO C 3>;>2=>  
8H5 =525;8:0 :V;L:VABL 0?@>B8=V=C ?@>=8:0T G5@57 ?;0F5=B0@=89 10@T@. ;0F5=B0 =5<>65  
22060B8AO ?>2=VABN =5?@>=8:=>N 4;O 0?@>B8=V=C, >4=0: H284:VABL ?5=5B@0FVW 2:@09 =87L:0.  
@>=8:5==O 0?@>B8=V=C C 3@C4=5 <>;>: =5 4>A;V46C20;>AO.

5B01>;V7<, 5;V

>;5:C;0 0?@>B8=V=C 2 =8@:0E ?V4 4VTN ;V7>A><0;L=8E D5@<5=BV2 @>7I5?;NTBLAO =0 :>@>BHV  
?5?B848 01> 0:8A;>B8. # ;N48=8 7 A5G5N 5:A:@5BCTBLAO <5=H5 5 % 2V4 22545=>W 4>78  
0?@>B8=V=C. VA;O 2=CB@VH=L>25==>3> 22545==O 74>@>28< 4>1@>2>;LFO< 0?@>B8=V=C 7 N 131  
I 2V4 25 % 4> 40 % ?>7=0G5=>W @5G>28=8 284V;ONBLAO ?@>BO3<< 48 3>48= V7 A5G5N C D>@  
0=8E I>4> 70AB>AC20==O ?@5?0@0BC ?0FVT=B0< V7 B5@N AB04VTN ?>@CH5==O DC=:FVW  
=8@>: I5 =5<0T, ?@>B5 C ?0FVT=BV2 V7 ?>@CH5==O< DC=:FV9 =8@>: =5 A?>AB5@V30;>AO  
;V=VG=> 7=0GCI8E D0@<0:>:V=5B8G=8E 7 >G5284=8E ?>1VG=8E 5D5:BV2. # 72O7:C 7 F8<  
A?5FV0;L=>W :>@5:FVW 4>78 C B0:8E 28?04:0E =5 ?>B@V1=>.

;V=VG=V E0@0:B5@8AB8:8.

>:070==O.

?@>B8=V= ?>:070=89 4;O ?@>DV;0:B8:8 7 <5B>N 7=865==O ?VA;O>?5@0FV9=>W :@>2>2B@0B8 V  
?>B@518 C 35<>B@0=ADC7VW C 4>@>A;8E ?0FVT=BV2, O:V <0NBL 28A>:89 @878: 25;8:8E  
:@>2>2B@0B ?@8 ?@>2545==V V7>;L>20=>3> A5@F52>;535=52>3> HC=BC20==O (B>1B>  
HC=BC20==O :>@>=0@=8E 0@B5@V9, O:5 =5 :<1V=CTBLAO 7 V=H8<8 A5@F52>-AC48==8<8  
2B@CG0==O<8).

@>B8?>:070==O.

V?5@GCB;82VABL 4> 4VNG>W @5G>28=8 (1V;>: 25;8:>W @>30B>W EC4>18), 48A20=5  
2=CB@VH=L>AC48==5 73>@B0==O :@>2V (-A8=4@><). # ?0FVT=BV2, C O:8E T 0=B8BV;0 gG,  
A?5F8DVG=V 4> 0?@>B8=V=C, ?@8 ;V:C20==V 0?@>B8=V=< A?>AB5@V30TBLAO ?V428I5=89  
@878: 0=0DV;0:AVW. # 72O7:C 7 F8< B5@0?VO 0?@>B8=V=< B0:8< ?0FVT=B0< ?@>B8?>:070=0.  
# @07V, O:I> ?@>2545==O B5ABC20==O =0 A?5F8DVG=V 0=B8BV;0 gG ?@>B8 0?@>B8=V=C ?5@54  
?>G0B:>< ;V:C20==O =5<>6;825, 0;5 ?5@5410G0TBLAO, I> ?0FVT=B >B@8B8=V=< 2?@>4>26  
?>?5@54=VE 12 B8=V=C ?@>B8?>:070=5.

70T<>4VO 7 V=H8<8 ;V:0@AL:8<8 70A>10<8 B0 V=HV 2848 270T<>4V9.

@5?0@0B =5 A;V4 7@>=OTBLAO 22545==O ?@5?0@0BC @07<< V7 @>7G8=0<8, O:V :8A;>B8 B0 ;V?V48.  
70;56=>ABV 2V4 4>78 >=B@825= 7=86CT 0:B82=VABL AB@5?B>:V=078 V C@>:V=078. >65 ?@83=VGC20B8 0:B82=VABL  
=5A?5F8DVG=>W E>;V=5AB5@078 A8@>20B:8 :@>2V. # E2>@8E 7V 7=865=>N 0:B82=VABN =5A?5F8DVG=>W  
E>;V=5AB5@078 ?@8 >4=>G0A=>AC20==V 0?@>B8=V=C 9 AC:A0<5B>=VN <>6;825 28=8:5==O 0?=>5, I> 7C<>2;5=>  
<07>2>N @5;0:A0FVTN.

?@>B8=V= V=3V1CT 4VN B@><1>;VB8G=8E ?@5?0@0BV2, C B>:V=078, C@>:V=078 V 0;LB5?;078  
(@-" = @5:><1V=0=B=89 B:0=8==89 0:B820B>@ ?;07V35=C), ?@8G>78 ?@5?0@0BC. @8  
=5>1EV4=>ABV <>6=0 @>72>48B8 C 0,9 % @>7G8=V =0B@VN E;>@84C 01>  
2545==O ?@5?0@0BC C 35?0@8=V7>20=C :@>2 71V;LHCT G0A 73>@B0==O FV;L=>W :@>2V.

A>1;82>ABV 70AB>AC20==O.

V:C20==O 0?@>B8=V=< <>65 AC?@>2>46C20B8AO ?>@CH5==O< DC=:FV9 =8@>:, >A>1;82> C  
?0FVT=BV2, 2 O:8E 265 T C@065==O =8@>:. # ?0FVT=BV2, O:8< ?@>2>48;0AO >?5@0FVO 0>@B>-  
:>@>=0@=>3> HC=BC20==O, 1C;> ?>:070=>, I> 2 3@C?V, O:0 >45@6C20;0 0?@>B8=V=,  
A?>AB5@V30;>AO ?V428I5==O @V2=O :@50B8=V=C 2 A8@>20BFV :@>2V =0 0,5 <3/4; ?>@V2=O=> 7  
=>@<0;L=8< 7=0G5==O< (482. @>74V; «\$0@<0:>48=02V4=>, ?5@54 ?@87=0G5==O< 0?@>B8=V=C  
?0FVT=B0< V7 ?>@CH5==O< DC=:FV9 =8@>: 01> B8<, O:V <0NBL @878: C@065==O =8@>:  
(=0?@8:;04, ?@8 >4=>G0A=>3;V:>7840<8) =5>1EV4=0 @5B5;L=0 >FV=:0 A?V22V4=>H5==O :>@8ABV

V @878:C.

?@>B8=V= =5>1EV4=> 7 >15@56=VABN 70AB>A>2C20B8 ?0FVT=B0< 7 0B>?VG=8< 45@<0B8B<, B>  
<>6CBL 28=8:0B8 ?A524>0;5@3VG=V @50:FVW.

@8 70AB>AC20==V 0?@>B8=V=C =5>1EV4=0 @5B5;L=0 >FV=:0 A?V22V4=>H5==O :>@8ABV V  
@878:C, >A>1;82> C ?0FVT=V2, O:V @0=VH5 265 70AB>A>2C20;8 0?@>B8=V= (C B>289 ?;>  
<1C20;L=89 <0B5@V0;, I> B8=V=), >A:V;L:8 C =8E <>65 @>728=CB8AO 0;5@3VG=0 @50:FVO (482.  
@>74V; <<>1VG=V @50:FVW»). %>G0 C 1V;LH>ABV 28?04:V2 0=0DV;0:AVO @>72820TBLAO ?VA;O  
22545==O 4>72>;5=>W 4>78 2?@>4>26 12 :@52V4><;5==O ?@> 28?04:8, :>;8 0=0DV;0:B8G=0 @50:FVO  
28=8;:0 ?@8 ?>2B>@=V9 5:A?>78FVW G5@57 12 2545==V B5@0?VW 0?@>B8=V=< =5>1EV4=> <0B8  
2 =0O2=>ABV 70A>18 5:AB@5=>W 4>?<>38 4;O ;V:C20==O 0;5@3VG=8E B0 0=0DV;0:B8G=8E  
@50:FV9.

#AV< ?0FVT=B0<, O:V >B@8B8=V=<, =5>1EV4=> A?>G0B:C 225AB8 B5AB>2C 4>7C, 4;O B>3> I>1  
>FV=8B8 =0O2=VABL AE8;L=>ABV 4> 0;5@3VG=8E @50:FV9 (482. @>74V; <!>AV1 70AB>AC20==O  
B0 4>78»). "5AB>2C 4>7C A;V4 22>48B8 ?0FVT=BC 2 >?5@0FV9=V9.

=B03>=VAB8 H1 V H2 <>6=0 22>48B8 70 15 E28;8= 4> ?@>2545==O B5ABC 7 0?@>B8=V=>  
"5AB>20 4>70 0?@>B8=V=C 4;O 2AVE ?0FVT=V2 <0T AB0=>28B8 1 ), ?VA;O G>3> =5>1EV4=>  
A?>AB5@V30B8 70 ?0FVT=B<< 2?@>4>26, O:

@>B5 =02VBL, =572060NG8 =0 2V4ACB=VABL CA:;04=5=L C ?5@V>4 ?VA;O 22545==O ?>G0B:>2>W  
4>78

1 <;, B5@0?52B8G=0 4>70 0?@>B8=V=C <>65 A?@8G8=8B8 0=0DV;0:B8G=C @50:FVN. # @07V, O:I>  
@>72820TBLAO 0=0DV;0:B8G=0 @50:FVO, V=DC7VN 0?@>B8=V=C A;V4 ?@8?8=8B8 V 268B8  
=5>1EV4=8E 5:AB@5=8E 70E>4V2.

# 7207:C 7 <>6;82VABN @>728B:C @50:FV9 3V?5@GCB;82>ABV (482. @>74V; <<>1VG=V @50:FVW»),  
?5@54 ?>G0B:>< 70AB>AC20==O ?@5?0@0BC =5>1EV4=> @5B5;L=> >FV=8B8 A?V22V4=>H5==O  
:>@8ABV V @878:C C :>6=>3> ?0FVT=B0, O:89 265 >B@8B8=V=< (482. @>74V; <<>1VG=V  
@50:FVW»).

# @07V, O:I> 2V4><>, I> ?0FVT=B 265 >B@8 B@82B>@=5 ;V:C20==O 0?@>B8=V=<, @5:>  
<5=4CTBLAO 4>B@81V6=8E 70E>4V2. /: 707=0G5=> C @>74V;V <!>AV1 70AB>AC20==O B0 4>78»,  
2AV< ?0FVT=B0<, O:

15 E28;8= 4> 22545==O B5AB>2>W 4>78 ?@5?0@0BC <>6=0 225AB8 0=B03>=VAB H1 (=0?@8:;04 ;:5  
<0AB8=) V 0=B03>=VAB H2 (=0?@8:;04, F8<5B848=). @8 =5>1EV4=>ABV 4;O ;V:C20==O 0;5@3VG=>W  
(0=0DV;0:B8G=>W) @50:FVW A;V4 28:>@8AB>2C20B8 AB0=40@B=V 70E>48 5:AB@5=>W 4>?<>38.

5 A;V4, >4=0:, 701C20B8 ?@> B5, I> B5@0?52B8G=0 4>70 <>65 A?@8G8=8B8 0;5@3VG=C @50:FVN,  
=02VBL O:I> ?0FVT=B 4>1@5 ?5@5=VA 22545==O ?5@28==>W 12>W B5AB>2>W 4>78, =5 707=02H8  
?@8 FL>4=8E =51060=8E A8F5 AB0;>AO, V=DC7VN 0?@>B8=V=C A;V4 =5309=> ?@8?8=8B8 V  
?@8ABC?8B8 4> ?@>2545==O AB0=40@B=8E 70E>4V2 5:AB@5=>W 4>?<>38 4;O ;V:C20==O  
0=0DV;0:B8G=>W @50:FVW.

# ?0FVT=V2, O:V >B@8B8=V=, 2V47=0G5=> ?V428I5==O G0AB>B8 @>728B:C ?>@CH5==O  
DC=:FVW =8@>: V ;5B0;L=>ABV, ?>@V2=O=> 7 ?>@V2=O;L=>N 70 2V:< :>=B@>;L=>N 3@C?>N, O:0  
E0@0:B5@87C20;0AO 0=0;>3VG=8< <548G=8< 0=0<=57<< V 2 O:V9 B0:>6 ?@>2>48;8AO >?5@0FVW  
=0 3@C4=>@B8 2 C<>20E HBCG=>3> :@>2>>1V3C V7 7C?8=:>N :@>2>>1V3C =0 B;V 3;81>:>W  
3V?>B5@B8=V= <>6=0 ?@87=0G0B8 ;8H5 7 :@09=L>N >15@56=VABN. 5>1EV4=> ?@>2>48B8  
2V4?>2V4=5 0=B8:>03C;O=B=5 ;V:C20==O 35?0@8=>

>40B:>2V 70C2065==O I>4> 70AB>AC20==O ?@5?0@0BC 2 C<>20E HBCG=>3> :@>2>>1V3C.  
;O ?V4B@8W 0=B8:>03C;O=B=>W 0:B82=>ABV =0 B;V HBCG=>3> :@>2>>1V3C ?@8 >4=>G0A=>  
AC20==V 0?@>B8=V=C @5:><5=4CTBLAO 28:>@8AB0==O 1C4L-O:>3> 7 B0:8E <5B>4V2:

I. :B82>20=89 G0A 73>@B0==O (!): '=5 <>65 @>73;040B8AO O: AB0=40@B=89 B5AB =0 :>03C;OFVN;  
V=B5@?@5B0FVO @57C;LB0BV2 FL>3> B5ABC 70;568BL 2V4 ?@8ACB=>ABV 0?@>B8=V=C. @V<  
B>3>, =0 @57C;LB0B8 B5ABC 2?;820NBL 2V4ABV, ?>2O70=V 7 @>72545==O<, V B5@8AB>2CTBLAO  
2 C<>20E HBCG=>3> :@>2>>1V3C. >:070=>, I> 2?;82 0?@>B8=V=C 28@065=> 2 <5=HV9 4>

:0>;V=>2>3> ', ?>@V2=O=> 7 'V7 28:>@8AB0==O< 4V0B><>2>W 75<;V (F5;VBC). 572060NG8 =0  
@V7=<0=VB=VABL ?@>B>:>;V2, @5:<5=4CTBLAO ?@>2>48B8 750-A5:C=4=89 B5AB ! V7  
28:>@8AB0==O< 4V0B><>2>W 75<;V 01> 480-A5:C=4=89 B5AB 'V7 28:>@8AB0==O< :0>;V=C 2  
?@8ACB=>ABV 0?@>B8=V=C, =570;56=> 2V4 ABC?5=O 35<>48;NFVW V 3V?>B5@=AC;LB0FVTN  
I>4> V=B5@?@5B0FVW @57C;LB0BV2 0=0;V7C 2 ?@8ACB=>ABV 0?@>B8=V=C =5>1EV4=>

725@=CB8AO 4> 28@>1=8:0 @50:B82V2 4;O '-B5ABC.

2. 2545==O ?>ABV9=8E 4>7C20=L 35?0@8=C: AB0=40@B=0 =020=B06C20;L=0 4>70 35?0@8=C, O:0 22>48BLAO 4> :0B5B5@870FVW A5@FO, 0 B0:>6 :V;L:VABL 35?0@8=C, O:0 4>40TBLAO 4> @>7G8=C ?5@28==>3> 70?>2=5==O 0?0@0BC HBCG=>3> :@>2>>1V3C, <0NBL AB0=>28B8 =5 <5=H5 350 /:3. >40B:>20 4>70 35?0@8=C 287=0G0TBLAO 7 C@0EC20==O< <0A8 BV;0 ?0FVT=B0 V B@820;>ABV 2B@CG0==O 2 C<>20E HBCG=>3> :@>2>>1V3C.

3. "8B@C20==O 35?0@8=?@>B0 =0 @57C;LB0B8 70AB>AC20==O FL>3> <5B>4C =5 2?;820T ?@8ACB=VABL 0?@>B8=V=C, B>7>N 35?0@8=C V 2V4?>2V44N =0 =5W A;V4 >FV=N20B8 70 4>?> <>3>N B8B@C20==O ?@>B0 >40B:>2C :V;L:VABL 35?0@8=C<>6=0 22>48B8 7 C@0EC20==O< :>=F5=B@0FVW 35?0@8=C, O:0 28?> <>3>N B8B@C20==O 7 ?@>B0=F5=B@0FVO 35?0@8=C 2 C<>20E HBCG=>3> :@>2>>1V3C =5 <0T 7=86C20B8AO =86G5 @V2=O 2,7 4/<; (2 <3/:3) 01> =86G5 4>78, O:0 287=0G5=0 ?@8 B5ABC20==V 70;56=>ABV 2V4?>2V4V 2V4 4>78 35?0@8=C, I> ?@>2>482AO 4> 22545==O 0?@>B8=V=C. VA;O 70:V=G5==O HBCG=>3> :@>2>>1V3C, O:I> ?0FVT=B >B@8B07@0E>2C20B8, 28E>4OG8 7 DV:A>20=>3> A?V22V4=>H5==O, O:5 287=0G0TBLAO 70 :V;L:VABN 22545=>3> 35?0@8=C 01> @>7@0E>2CTBLAO 70 4>?><>3>N <5B>4C B8B@C20==O 7 ?@>B0 06;82>: 70AB>AC20==O 0?@>B8=V=C =5 >7=0G0T, I> ?>B@510 C 35?0@8=V 7=86CTBLAO; 0?@>B8=V= =5 <>6=0 70AB>A>2C20B8 O: 35?0@8=-715@V30NG89 70AV1.

0AB>AC20==O C ?5@V>4 203VB=>ABV 01> 3>4C20==O 3@C44N.

45:20B=8E V 4>1@5 :>=B@>;L>20=8E 4>A;V465=L C 203VB=8E 6V=>: =5 ?@>2>48;>AO. 0AB>AC20==O C ?5@V>4 203VB=>ABV: @57C;LB0B8 4>A;V465=L =0 B20@8=0E =5 2:07CNBL =0 =0O2=VABL B5@0B>35==>3> 01> 5<1@V>B>:A8G=>3> 5D5:BC 0?@>B8=V=C. ?@>B8=V= ?@>B8?>:070=89 C B@8<5AB@V 203VB=>ABV V 9>3> =5 A;V4 70AB>A>2C20B8 C B0 B@8<5AB@0E 203VB=>ABV, 70 28=OB:< B8E 28?04:V2, :>;8 ?>B5=V9=0 :>@8ABL ?5@528ICT >GV:C20=89 @878:.. # 28?04:C @>728B:C A5@9>7=8E =51060=8E @50:FV9 (B0:8E O: 0=0DV;0:B8G=V @50:FVW, 7C?8=:0 A5@FO B>I>) V ?V4 G0A WE ;V:C20==O ?@8 >FV=FV @878:C V :>@8ABV A;V4 1@0B8 4> C2038 ?>B5=V9=C =5157?5:C =0=5A5==O H:>48 ?>;4C (482. @>74V; «A>1;82>ABV 70AB>AC20==O»). 52V4><>, G8 5:A:@5BCTBLAO 0?@>B8=V=C 3@C4=5 <>;>: =D>@<0FVO ?@> 70AB>AC20==O >=B@825=C C ?5@V>4 3@C4=>3> 3>4C20==O 2V4ACB=O. 4=0:, >A:V;L:8 0?@>B8=V= =5 T 1V>4>ABC=?<8< ?@8 ?5@>@0;L=> ?>B@0?8;0 C 3@C4=5 <>;>:, =5 2?;820B8<5 =0 >@30=V7< 48B8=8.

40B=VABL 2?;820B8 =0 H284:VABL @50:FVW ?@8 :5@C20==V 02B>B@0=A?>@B< 01> V=H8<8 <5E0=V7<0<8.

@5?0@0B <>6=0 70AB>A>2C20B8 BV;L:8 2 C<>20E AB0FV>=0@C.

!>AV1 70AB>AC20==O B0 4>78.

5@54 ?>G0B:<< 22545==O ?@5?0@0B0 2AV< ?0FVT=B0< =5>1EV4=> ?@>25AB8 B5AB =0 0=B8BV;0 IgG, A?5F8DVG=V 4> 0?@>B8=V=C (482. @>74V; «@>B8?>:070==O»). 0 28=OB:<< 28?04:V2, :>;8 E0@0:B5@ ?@87=0G5=L 2V4@V7=OTBLAO, 4;O 4>@>A;8E ?0FVT=BV2 @5:><5=4CNBLAO B0:V 4>7C20==O ?@5?0@0BC: "5AB-4>70.

#=0A;V4>: @878:C @>728B:C 0;5@3VG=>W (0=0DV;0:B8G=>W) @50:FVW 2AV< ?0FVT=B0< A;V4 225AB8 2=CB@VH=L>25==> 10000 (:0;V:@5W=-V=3V1CNG8E >48=8FL) 0?@>B8=V=C (1 <;), O: =B03>=VAB8 H1 V H2 <>6=0 22>48B8 70 15 E28;8= 4> ?@>2545==O B5ABC 7 0?@>B8=V=>1EV4=> <0B8 2 =0O2=>ABV >1;04=0==O 4;O ?@>2545==O AB0=40@B=>3> B5@2>3> ;V:C20==O 0=0DV;0:B8G=8E B0 0;5@3VG=8E @50:FV9.

V4 G0A >?5@0FV9 =0 2V4:@8B<< HBCG=>3> :@>2>>1V3C) 4;O 7=865==O :@>2>2B@0B8 V ?>B@518 2 35<>B@0=ADC7VW: >7C20==O.

VA;O 22545==O 2 =0@:>7 (0;5 4> ?@>2545==O AB5@=>B<5=4CTBLAO 225AB8 =020=B06C20;L=C 4>7C 2V4 1000000 4> 2000000 H;OE<< ?>2V;L=>W 2=CB@VH=L>25==>W V=T:FVW 01> V=DC7VW 2?@>4>26 20-30 E28;8=. 0ABC=?V 1000000-2000000 A;V4 22>48B8 ?VA;O 2:;NG5==O 0?0@0BC HBCG=>3> :@>2>>1V3C. <5B>N C=8:=5==O DV78G=>W =5ACABV 0?@>B8=V=C B0 35?0@8=C, O:89 4>40TBLAO 4> @>7G8=C ?5@28==>3> 70?>2=5==O =0A>A0, :>65= ?@5?0@0B A;V4 4>4020B8 4> @>7G8=C ?5@28==>3> 70?>2=5==O =0A>A0 C ?@>F5AV @5F8@:C;OFVW, 4;O B>3> I>1 70157?5G8B8

4>AB0B=T @>72545==O >1>E ?@5?0@0BV2 4> B>3>, O: 2>=8 748= 7 >4=8G0B:>2>W 1>;NA=>W  
V=DC7VW C 28A>:V9 4>7V A;V4 22>48B8 2V4 250000 4> 500000 =0 3>48=C H;OE<< 157?5@5@2=>W  
V=DC7VW 4> 70:V=G5==O >?5@0FVW.

# FV;>B8=V=C, 22545=>3> 2?@>4>26 ;V:C20;L=>3> F8;;C, =5 ?>28==0 ?5@528IC20B8 6000000 , I>  
>?>2O70=> 7 2< 15=78;>2>3> A?8@BC 2 V='T:FV9=>7G8=V (482. @>74V; «A>1;82>ABV  
70AB>AC20==O»).

?@>B8=V= 4;O 2=CB@VH=L>25==>3> 22545==O A;V4 22>48B8 G5@57 F5=B@0;L=89 25=>7=89  
:0B5B5@, O:89 =5 A;V4 28:>@8AB>2C20B8 4;O 22545==O 1C4L-O:>3> V=H>3> ;V:0@AL:>3>  
?@5?0@0BC.

@5?0@0B <>6=0 22>48B8 BV;L:8 ?0FVT=B0<, O:V 7=0E>4OBLAO C ?>;>65==V ;560G8; 22545==O A;V4  
?@>2>48B8 ?>2V;L=> (<O:A8<0;L=0 H284:VABL 2V4 5 4> 10<; =0 E28;8=C) H;OE<<  
2=CB@VH=L>25==>W V=T:FVW 01> :>@>B:>AB@>:>2>W V=DC7VW.

0FVT=B0< V7 ?>@CH5==O< DC=:FV9 =8@>.: 73V4=> 7 =0:>?8G5=8< 4> B5?5@VH=L>3> G0AC  
;;V=VG=8< 4>A2V4<<, :>@5:FVO 4>78 =5 ?>B@V1=0.

0AB>AC20==O ?0FVT=B0< ;VB=L>3> 2V:C: 2V4?>2V4=> 4> =0O2=>3> =0 40=89 G0A ;;V=VG=>3>  
4>A2V4C, ?0FVT=B0< ;VB=L>3> 2V:C =5 <0T ?>B@518 7

5 <>6=0 70AB>A>2C20B8 ?@5?0@0B, O:I> 28O2;5=> ?>1EV4=> =5309=> 70AB>AC20B8.

VB8. D5:B82=VABL B0 157?5:0 70AB>AC20==O ?@5?0@0BC 4VBO< =5 2AB0=>2;5=V.

5@54>7C20==O. !8<8 ?5@54>7C20==O 01> V=B>:A8:0FVW =5 >?8A0=V. !?5F8DVG=>3> 0=B84>BC =5  
VA=CT. 5:>5=4CTBLAO ?@>2545==O A8<0B8G=>3> ;V:C20==O.

>1VG=V @50:FVW.

# ?0FVT=BV2, O:V >B@8B8=V= 2?5@H5, @>728B>: 0;5@3VG=8E 01> 0=0DV;0:B8G=8E @50:FV9 <0;>9  
<>2V@=89. # @07V ?>2B>@=>3> 22545==O G0AB>B0 @>728B:C 0;5@3VG=8E (0=0DV;0:B8G=8E)  
@50:FV9 <>65 4>AO30B8 5 %. @8 @5B@>A?5:B82=> ?>:070=>, I> WE G0AB>B0 ?V428ICTBLAO C  
28?04:C, O:I> ?>2B>@=5 22545==O <0T 4>26 6 3> ;V:C20==O (G0AB>B0 AB0=>28BL 5 % ?@8  
>?>2B>@=V9 5:A?>78FVW 2?@>4>26 6 2B>@=V9 5:A?>78FVW ?VA;O 70:V=G5==O 6 ?>:070=>, I>  
G0AB>B0 BO6:8E 0=0DV;0:B8G=8E @50:FV9 4>40B:>2> 71V;LHCTBLAO C ?0FVT=BV2, O:V  
2?@>4>26 6 B@8B8=V= 1V;LH5 2 @07V2. 02VBL C 28?04:C, O:I> ?0FVT=B 4>1@5 ?5@5=VA ?>2B>@=5  
;V:C20==O 0?@>B8=V=<<, =0ABC?=5 22545==O <>65 A?@8G8=8B8 BO6:C 0;5@3VG=C @50:FVN 01>,  
C 2:@09 @V4:VA=8E 28?04:0E, 0=0DV;0:B8G=89 H>: 7 ;5B0;L=V< =0A;V4:>

!8<8 0;5@3VG=8E 01> 0=0DV;0:B8G=8E @50:FV9:

7 1>:C A5@F52>-AC48==>W A8AB5<8: 0@B5@V0;L=0 3V?>B5=7VO, ?@8A:>@5=89 ?C;LA,  
>?@CH5==O A5@F52>3> @8BA8=V==O 3C1;

7 1>:C B@02=>W A8AB5<8: =C4>B0;

7 1>:C 48E0;L=>W A8AB5<8: 1@>=EV0;L=0 0AB<0 (1@>=E>A?07<);

7 1>:C H:V@8 B0 WW ?@840B:V2: A25@1V6, :@>?82O=:0, H:V@=V 28A8?0==O, 1;V4VABL H:V@8;  
A8EVG=V @>7;048: ?A8E>78, 30;NF8=0FVW, A?;CB0=VABL A2V4>>ABV;

=HV: 7048H:0, @OA=5 ?>B>284V;5==O.

/:I> 0;5@3VG=0 @50:FVO @>72820TBLAO ?V4 G0A V=T:FVW G8 V=DC7VW, B> 22545==O

?@5?0@0BC =5>1EV4=> =5309=> ?@8?8=8B8. !;V4 28:>@8AB>2C20B8 AB0=40@B=V 70E>48

5:AB@5=>W 4>?><>38, C B> :>@B8:>AB5@>W4V2, V=DC7V9=C B5@0?VN.

!5@F52>-AC48==0 A8AB5<0.

# ?0FVT=BV2, O:8< ?@>2>48;0AO >?5@0FVO 0>@B>:>@>=0@=>3> HC=BC20==O, =5 240;>AO ?@>45  
<=>AB@C20B8 VAB>B=8E 2V4AB59 70 :V;L:VABN 28?04:V2 V=D0@:BC:0@40 ?>@V2=O=> 7 28?04:0  
<8 ;V:C20==O ?;0F51>. # 45O:8E 4>A;V465==OE A?>AB5@V30;0AO B5=45=FVO 4> 71V;LH5==O  
G0AB>B8 V=D0@:BC :0@40 ?V4 G0A 22545==O 0?@>B8=V=C, C B>9 G0A O: 2 V=H8E 4>A;V465==OE,  
=02?0:8, 2V47=0G5=5 7=865==O :V;L:>ABV 28?04:V2 V=D0@:BC:0@40.

A;V;L:8 70240==O< 28I5707=0G5=8E 4>A;V465=L =5 1C;> 28O2;5==O 2V4AB59 C G0AB>BV @>728B:C  
V=D0@:BC :0@40, ?V428I5==O V<>2V@=>ABV @>728B:C ;;V=VG=> 7=0GCI8E ?>1VG=8E 5D5:BV2 =5  
<>65 1CB8 AB0B8AB8G=> 4>AB>2V@=> 28;;NG5=>.

# 4>A;V465==V, 2 O:>2>48;0AO ?5@H0 >?5@0FVO 0>@B>:>@>=0@=>3> HC=BC20==O, @878:

>;N7VW B@0=A?;0=B0B0 28O282AO 28I8< C ?0FVT=BV2, O:V >B@8B8=V=, ?>@V2=O=> 7 3@C?>N

?;0F51>. /: 1C;> ?>:070=> ?@8 ?>2B>@=>4=>2>48;0AO =5045:20B=0 35?0@V=V70FVO, 0 2 V=H>

@8AB>2C202AO =5AE20;5=89 <5B>4 :>=A5@2C20==O B@0=A?;0=B0BV2. @V< 70C2065=L, I>

AB>ACNBLAO 35?0@8=V70FVW (482. @>74V; «A>1;82>ABV 70AB>AC20==O»), A;V4 2:070B8 =0  
 01A>;NB=C =5?@89=OB=VABL ?@0:B8:8 2V41>@C 7@07:V2 :@>2V 4;O B5ABC20==O 7 >A=>2=>W  
 2=CB@VH=L>25==>W A8AB5<8, I> 28:>@8AB>2C20;0AO 4;O 22545==O 0?@>B8=V=C. C@0EC20==O  
 < F8E G8==8:V2, :@5<8<8 ;V:C20;L=8<8 3@C?0<8 =5 1C;> 28O2;5=> 2V4AB59 70 G0AB>B>N  
 28=8:=5==O V=D0@:BC :0@40 01> 70 ?>:07=8:<< ;5B0;L=>ABV.

51060=V @50:FVW, O:V 287=0G0NBLAO O: «G0AB> 7CAB@VG0NBLAO», A?>AB5@V30;8AO 7  
 G0AB>B>N <5=H5 2 %.

51060=V 5D5:B8, I> A?>AB5@V30;8AO 2?@>4>26 ?>AB<0@:5B8=3>2>3> 70AB>AC20==O (n = 556  
 ?>2V4><;5=L, AB0=<< =0 3@C45=L 2004 (@>:C), 2V47=0G5=V :C@A82>

# <560E >:@5<8E G0AB>B=8E :0B53>@V9 =51060=V @50:FVW 707=0G5=V C ?>@O4:C 7=865==O  
 B06:>ABV.

;V=VG=89 >?8A	'0AB> 2V4 > 1 % 4> < 10 %	5G0AB> 2V4 > 0,1 % 4> < 1 %	>>48=>:V 2V4 > 0,01 % 4> < 0,1 %	V4:VA=V < 0,01 %
!8AB5<=V ?>@CH5==O B0 @50:FVW C				
50:FVW C				50:FVW, O:V 28=8:;8 C  ("@"><1>)D;51VB C
1>:C A5@FO				
>@CH5==O 7 1>:C :0@40.	=D0@:B :0@40.	H5:0@40 ::N7VO/B@"><1>7 :>@">=0@=8E 0@B5@V9.		
5@V:0@4V0;L=89 28?VB.		5@V:0@4V0;L=89 28?VB.		
1>:C AC48=				
<1>;VW B0 B@"> <1>78.		"@"><1>7.	@B5@V0;L=89 B@"><1>7 (B0 9>3> D>@"<8, E0@0:B5@=V 4;O 68BBT2> 206;828E >@"30=V2, =0?@"8:;04, =8@">.; ;535=V2, 3>;>2=>3> <>7:C).	"@"><1>5<1>;VO ;535=52>W 0@B5@VW.
1>:C A8AB5<8 :@">2V B0 ;VW A8AB5<8				
>@CH5==O 73>@B0==O :@">2V.				8A520=5 2=CB@VH=L>AC- 48==5 73>@B0==O (). >03C;>?0BVO.
1>:C VW A8AB5<8				

;V=VG=89 >?8A	'0AB> 2V4 > 1 % 4> < 10 %	5G0AB> 2V4 > 0,1 % 4> < 1 %	>>48=>:V 2V4 > 0,01 % 4> < 0,1 %	V4:VA=V < 0,01 %
>AB@V @50:FVW 3V?5@GCB;82>ABV.			;5@3VG=V @50:FVW. =0DV;0:B8G=V / 0=0DV;0:B>W4=V @50:FVW.	=0DV;0:B8G=89 H>: (I> ?>B5=FV9=> 703@>6CT 68BBN).
1>:C =8@>: B0 A5G>282V4=>N A8AB5<8				
>@CH5==O DC=:FV9 =8@>:.		>@CH5==O DC=:FV9 =8@>:. >AB@0 =8@>:20 =54>AB0B=VABL. 5:@>7 =8@>:28E :0=0;LFV2. ;V3C@VO.		

0ABC?=V 4>40B:>2V ?>1VG=V @50:FVW 1C;8 28O2;5=V C ?VA;O@5TAB@0FV9=>4V ?@8  
70AB>AC20==V 0?@>B8=V=C: 3V?5@57=>1, 3V?5@B5@

"5@ABV. 2 @>:8.

#<>28 715@V30==O. # >@83V=0;L=V9 C?0:>2FV 4;O 70E8ABC 2V4 4VW A2VB;0 ?@8 B5 >! 4> 8 >!. 15@V30B8 C =54>ABC?=>

5AC

?@>B8=V= A;V4 22060B8 ?@0:B8G=> =5AC:8A;>B8 V 68@8.

#?0:>2:0. > 1 <; (10000 ) 01> ?> 5 <; (50000 ) 2 0 10; ?> 1 <; 2 0 5 <; 2 0

0B53>@VO 2V4?CA:C. 0 @5F5?B>

8@>1=8:. @" «\$», #: @0W=0;  
"«\$«\$», #: @0W=0.

VAF57=0E>465==O 28@>1=8:0 B0 9>3> 04@5A020465==O 4VO;L=>ABV.

#: @0W=0, 03680,

#: @0W=0, 09100, 8W2AL:0 >1;.,