

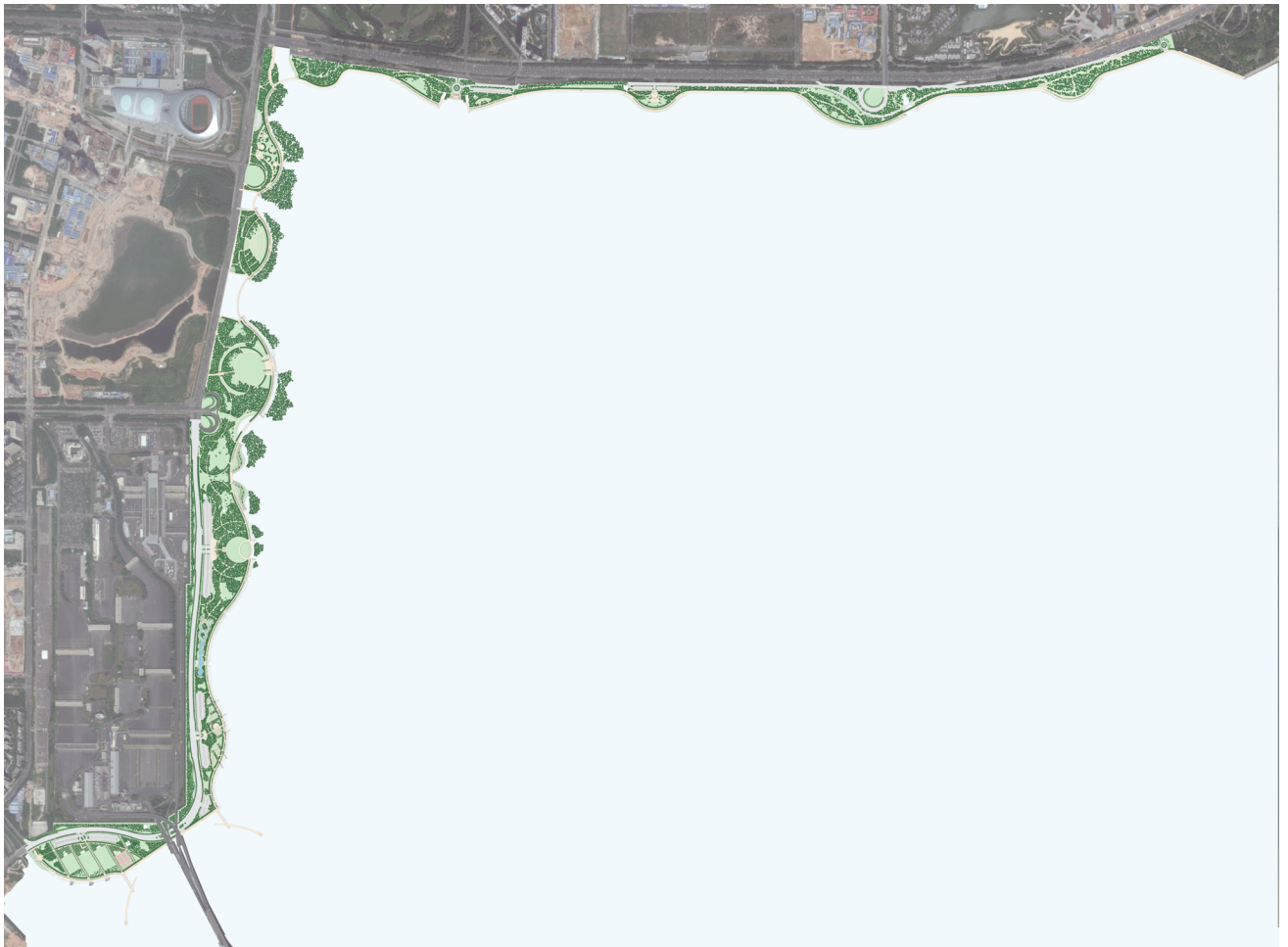


Shenzhen Bay Coastline Park Phase 1, Shenzhen, China

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0' 2000'





Environmental Benefit 1: Restores coastal mangrove ecologies

Restores 24.83 acres of coastal mangrove and tidal mudflats.

- Mangrove 13
- Mangrove 12
- Mangrove 11
- Mangrove 10
- Mangrove 9
- Mangrove 8
- Mangrove 7
- Mangrove 6
- Mangrove 5
- Mangrove 4
- Mangrove 3
- Mangrove 2
- Mangrove 1



1000 ft





- Calculations:
 - Areas of off-shore mangrove ecology were traced in Google Earth and the area of those calculated.

Mangrove 1	0.13 acres
Mangrove 2	0.37 acres
Mangrove 3	0.36 acres
Mangrove 4	0.99 acres
Mangrove 5	3.00 acres
Mangrove 6	4.4 acres
Mangrove 7	1.58 acres
Mangrove 8	4.49 acres
Mangrove 9	3.65 acres
Mangrove 10	3.33 acres
Mangrove 11	1.51 acres
Mangrove 12	0.21 acres
Mangrove 13	0.81 acres
TOTAL	24.83 acres

- Limitations:
 - Tracing from satellite imagery is susceptible to human error.
 - This method does not account for differences in quality that may exist in these areas of ecology.
- Sources:
 - Google Earth, 2016.

Environmental Benefit 2: Sequesters an estimated 934.13 tons of carbon annually

Sequesters an estimated 934.13 tons of carbon annually through on-site plantings. This annual rate is equivalent to the amount of energy used by 328 American homes for one year.

- Calculations:
 - Calculations have been performed using i-Tree Canopy.
 - First, a project area is set in Google Earth through the i-Tree Canopy web application. In this case, the project area was set to be the boundaries of Shenzhen Bay Coastline Park.
 - Second, to create an accurate data set, a number of “classes” were added to the analysis. The program creates automatically two classes, tree and non-tree. non-tree was replaced with a number of categories to more accurately represent the content of the park. The following classes were added to the data set: hardscape (impervious surfaces), building, water, shrub, grass, and permeable non-grass



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- (which included decomposed granite and permeable paving).
- Third, the project location Miami Dade County, Florida, USA was selected as the project location and denoted as “urban.” iTree canopy is developed by the United States Forest Service and only provides analysis for US locations. Miami Dade County was selected as it is located at a similar degree of latitude as Shenzhen and features similar climate. Shenzhen Bay Coastline Park is located at a latitude of 22°31’09.2”N, while Miami Dade County is located at a latitude of 25°07’47.0”N.
- Points were added on the satellite imagery until all classes present in the park were represented with an error margin of 1.75% or less.
- At this point, the following report was created:

Benefit	Amount	±SE
Carbon monoxide removed annually	165.88 lb	± 6.79
Nitrogen dioxide removed annually	1034.99 lb	±42.35
Ozone removed annually	3.48 tons	±0.14
Particulate Matter less than 2.5 microns removed annually	321.33 lb	±13.15
Sulfur Dioxide removed annually	7.24 oz	±0.30
Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	1.40 T	±0.06
Carbon dioxide sequestered annually in trees	934.13 tons	±38.22
Carbon dioxide stored in trees (not an annual rate)	15,123.07 tons	±618.75

- Limitations:
 - Since the data is based on users assigning classes to randomly placed points using aerial satellite photography, the classification of points is subject to human error. Certain classes are particularly difficult to distinguish from one another in satellite photography, such as trees and shrubs. However, by placing a considerable number of points, until the standard of error for the data was below 1% for all classes.
 - Although this is a scientifically developed tool, it is still an approximation for the conditions on site.
- Sources:
 - iTree Canopy: <http://www.itreetools.org/canopy/>
 - US Environmental Protection Agency, ‘Greenhouse Gas Equivalences Calculator’



Environmental Benefit 3: Affords habitat to more than 50 bird species

Affords habitat to more than 50 bird species, including the ruddy turnstone (*Arenaria interpres*), the common greenshank (*Tringa nebularia*), and the pied avocet (*Recurvirostra avosetta*).

- Calculations:
 - Areas of off-shore mangrove ecology were traced in Google Earth and the area of those calculated.

Year	No. of surveys	No. of species	Waterbird total counts	No. of threatened species	Threatened species total counts
2010	12	58	130,607	2	164
2011	12	57	98,400	2	85

China Coastal Waterbird Census Report, January 2010 – December 2011, 176.

- Limitations:
 - This data is derived from the larger area of Shenzhen Bay, so there may be specialized pockets of habitat supporting some species which are not present in the park ecologies specifically.
- Sources:
 - Ernest Kleinwort Charitable Trust and Asian Waterbird Conservation Fund, “China Coastal Waterbird Census Report, January 2010 – December 2011” http://chinabirdnet.org/document/waterbirdreport_10to11.pdf
 - Shenzhen Bird Watching Society, <http://www.szbird.org.cn/>

Environmental Benefit 4: Stabilizes temperatures along the coastline

Stabilizes temperatures along the coastline for park users. On-site temperatures (air readings) rose on average 5.76°F from morning to afternoon, as opposed to adjacent sites which rose 9.18°F on average during the same period.

- Calculations:

	Afternoon Average	Morning Average	Difference
Non-Park	97.68	88.50	9.18
Park	96.41	90.65	5.76

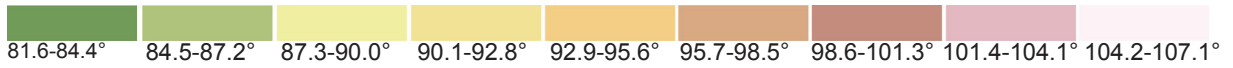
- A 200’ grid was placed over the site. The resulting points were labeled with a numbering and lettering system.
- Temperatures were recorded at each of the accessible points at three times of day between July 7, 2016 and July 10, 2016: Morning (9:00-10:30 AM), afternoon (12:30-2:00 PM) and evening (6:00-8:30 PM).
- Temperatures were taken using a digital thermometer, Protech MS6508.
- Temperatures were taken while holding the thermometer approximately 5 feet above ground, with the thermometer shaded to prevent readings from being influenced by radiant heat from the sun. When a temperature location was not



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**Relative temperature
9:00-10:30 AM**



**Relative temperature
1:00-3:00 PM**





- located in the shade, the temperature device was shielded from the sun with an opaque shield.
- Field temperatures taken in the park and adjacent to the park were averaged for each time of day.
- Averaged morning temperatures were then subtracted from the averaged afternoon temperatures to see how quickly temperatures increased.
- See Appendix A for temperature data and grid mapping.

- Limitations:
 - Due to the size of the park, it was not possible to take all the readings on the same day.

- Sources:
 - Independently taken temperature measurement

Social Benefit 1: Hosts many events, both cultural and entertainment. •

Hosts a range of cultural and sporting events annually, including the city's annual Cross Shenzhen Hiking Festival, where 60,000 people participated in 2016.

- Sources:
 - Xingqi Si, "Shenzhen Bay Park in Mass Wedding" November 13, 2014, translated by Ruoxi Cao, July 20, 2016 http://epaper.southcn.com/nfdaily/html/2014-11/13/content_7369307.htm
 - Zhu Xiaofang, "The Trendiest Wedding in Shenzhen Bay: Nine Young Couples Married" Shenzhen News, November 23, 2015, translated by Ruoxi Cao, July 20, 2016 http://www.sznews.com/news/content/2015-11/23/content_12515145.htm
 - Li Xiaobin "F1 Boats Roar in Houhai" Shenzhen News, October 17, 2007 http://www.sznews.com/epaper/szwb/content/2007-10/17/content_1583746.htm
 - "We on the top of Mountain Nan, look up at the starry sky of culture: Shenzhen Bay celebrates the grass and music festival" Sohu April 26, 2016, translated by Jiaying Mu, July 23, 2016 <http://mt.sohu.com/20160426/n446252222.shtml>

Social Benefit 2: Accommodates a wide array of experiences and social use.

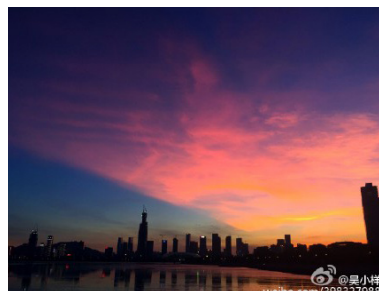
Accommodates a wide array of experiences and social uses through its use of different cultural spaces. Of 446 images geotagged at Shenzhen Bay Coastline Park and publicly posted in June 2016 to Weibo, a Chinese microblogging website similar to Twitter, 32.7% feature the city skyline, while an additional 30% focus on showing nature, 7.2% focus on recreational activities, 9.9% capture events and social activities, and 7.4% featuring wedding photography.

- Calculations:
 - Photographs posted on the Chinese social media site Weibo were collated and organized for the month of June, which totaled 446 images.
 - Photographs were organized by their content into the categories below. In photographs which contained multiple elements were categorized based on the main focus or motivation for the framing of the photograph.

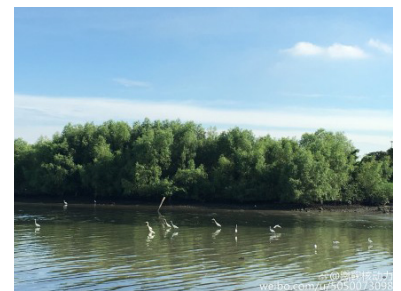
Weibo	Quantity	Percent
Bridge views	36	8.07%
City skyline	146	32.74%
Events and social activities	44	9.87%
Nature and natural views	134	30.04%
Other	21	4.71%
Recreation	32	7.17%



Bridge view
<https://www.weibo.com/u/wubingfeng1989>



City skyline
<https://www.weibo.com/>



Nature/natural views
<https://www.weibo.com/u/5050073098>



Recreation
<https://www.weibo.com/u/2083006755>



Social events
<https://www.weibo.com/u/5291832134>



Weddings
<https://www.weibo.com/vaeqiji>



- Limitations:
 - Not all photo posts are made public.
 - Park users of lower economic levels may not have the same access to internet and internet capable cell phones, and their park usage patterns and priorities may be under- or unrepresented in the data.
 - Since categorizing the images is a somewhat subjective process despite attempts at objectivity, categorization of the photos is subject to implicit bias and/or human error.

- Sources:
 - Shenzhen Bay Coastline Park, Weibo <http://weibo.com/>

Social Benefit 3: Acts as a major tourist draw and contributes to the identity of the city

Acts as a major tourist draw and contributes to the national and international identity of the city as evidenced through its 4.5 (out of 5) star rating on Trip Advisor. It is rated the 19th best attraction (out of 485) in Shenzhen.

- Calculations:

Trip Advisor		
Bridge view	1	3.03%
city skyline	10	30.30%
Events/social	1	3.03%
natural views/nature	11	33.33%
other	7	21.21%
Recreation	3	9.09%
Total:	33	

- Limitations:
 - Since categorizing the images is a somewhat subjective process despite attempts at objectivity, categorization of the photos is subject to implicit bias and/or human error.

- Sources:
 - “Shenzhen Bay Park,” Trip Advisor https://www.tripadvisor.com/Attraction_Review-g297415-d2630813-Reviews-Shenzhen_Bay_Park-Shenzhen_Guangdong.html



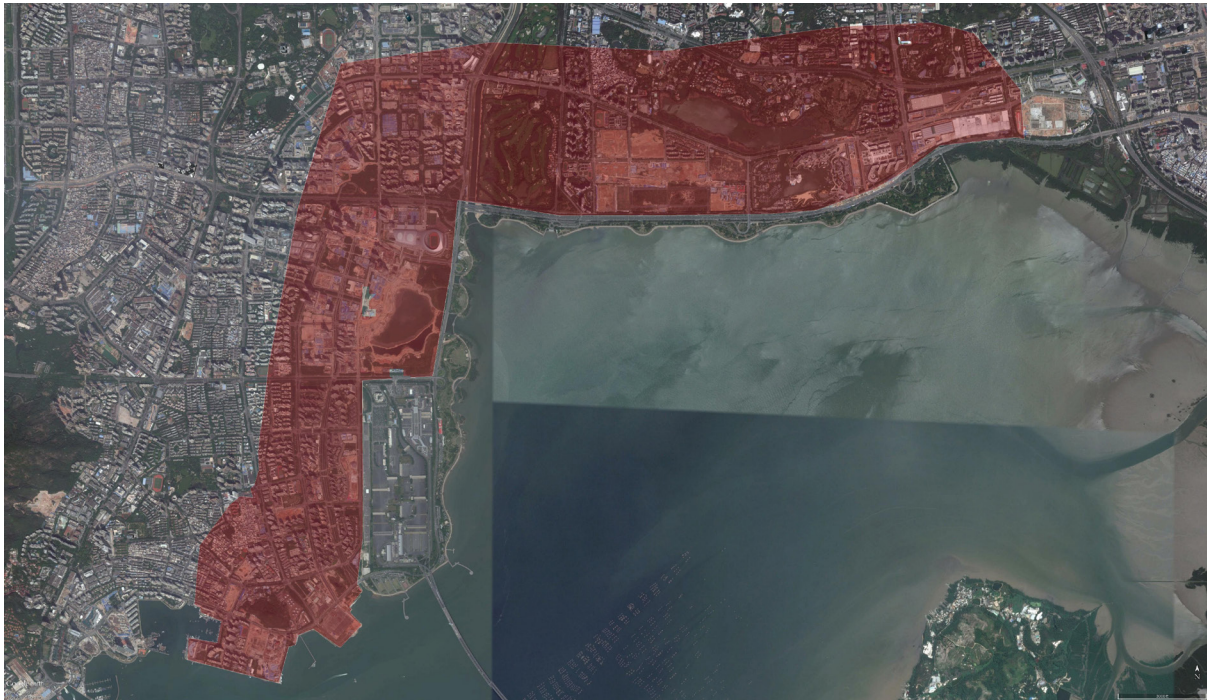
Economic Benefit 1: Creates jobs

Creates 9 full-time jobs and 400 part-time positions for gardeners and maintenance workers in the park.

- Sources:
 - Hao Liang, personal communication, July 20, 2016 (source from park manager).

Economic Benefit 2: Provides a strong coastal anchor to attract development

Provides a strong coastal anchor to attract residential development, including large-scale projects which are currently under construction and increases the value of existing nearby residential units with an estimated influence area of 4,483 acres.



- Calculations:
 - Conclusions drawn from research published in “Impact of Urban Green Space on Residential Housing Prices: Case Study in Shenzhen” state that park presence contributes to increased housing values in Shenzhen and that the average radius of park influence on surrounding properties is 1.73 kilometers.
 - Using Google Earth, distances inland from Shenzhen Bay Coastline Park at a distance of 1.73 kilometers were measured, and a resultant area was drawn that covered the approximate area of influence.
 - The Customs and Immigration station located adjacent to the south end of the park



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- was not included in this area as it is not eligible to be used as residential housing.
The resulting area as calculated by Google Earth was 4,483 acres.
- Limitations:
 - The data used in The Impact of Urban Green Space on Residential Housing Prices: Case Study in Shenzhen is based on a park inventory completed before Shenzhen Bay Coastline Park was completed, so the Coastline Park did not contribute to the original analysis.
 - There is no database of home sale prices available in the area so all home sales prices were self-reported to the researchers..
- Sources:
 - Jiansheng Wu, Meijuan Wang, Weifang Li, Jian Peng, and Li Huang, "Impact of Urban Green Space on Residential Housing Prices: Case Study in Shenzhen" Journal of Urban Planning and Development, December 2015, Volume 141, Issue 4.
 - Google Earth, 2016.



Appendix A: Temperature Data

Temperature Sites





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	TEMP Morning	TEMP Afternoon	TEMP evening
A91	95.3	99.10	88.50
A93	94.6	95.10	88.10
AA15	82.8	101	90.2
AA17	83.1	101	91.9
AA19	82.9	99.6	91.5
AAA13	83.8	100	90.6
AAA15	84	100	90.8
C89	96	98.40	87.40
C93	93.30	93.50	86.70
C95	91.00	93.20	86.50
C97	92.10	93.10	88.50
CCC13	83.5	100	90.2
CCC15	83.8	100	90.8
E85	94.5	97.50	87.40
E87	94.9	98.20	87.20
E91	92.50	93.60	86.50
E93	91.10	93.90	86.30
E95	90.80	93.30	86.10
E97	91.30	92.90	86.40
EE17	83.2	100	92.1
EEE13	84.1	101	89.9
EEE15	83.6	100	91
G81	94.8	96.40	87.90
G83	94.6	96.70	87.70
G87	91.50	94.10	87.00
G89	91.00	93.00	86.50
G91	90.20	92.50	86.30
G93	90.30	91.80	86.90
G95	90.80	92.80	86.70
G97	91.00	92.60	86.80
GG17	83.2	98	92.1
GGG13	83.4	101	89.4
GGG15	82.7	100	91.2
I21	92.1	97.60	86.30
I23	91.7	97.80	85.60
I25	90.4	97.10	85.40
I27	90.3	96.40	85.40
I29	89.4	96.00	86.70
I31	89.2	96.00	86.80
I33	90.2	99.40	86.30
I75	94.8	97.50	87.40
I77	94.2	98.20	87.60
I79	94.9	102.00	87.90
I83	94.90	94.20	89.40



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I85	98.50	95.70	89.40
I87	95.10	94.20	88.50
I89	93.80	91.50	87.40
I91	90.80	93.30	87.70
I93	90.60	93.00	86.90
I95	91.00	92.20	88.30
II17	83.4	98.5	92.1
III13	83.1	101	90.3
III15	83.2	100	91
K21	95.5	98.50	87.60
K23	95.8	97.30	87.00
K25	98.2	98.00	87.20
K27	98.7	99.30	86.80
K35	91.5	100.00	86.10
K37	90.8	96.20	86.30
K39	91.5	96.00	86.70
K41	91.3	95.30	86.50
K43	91.5	95.30	86.50
K45	91.2	96.20	86.80
K47	91.2	94.60	86.80
K49	91.3	95.70	86.80
K51	90.4	95.10	86.70
K53	90.8	94.80	85.80
K55	91.7	94.80	85.60
K57	92.8	95.70	85.80
K59	92.8	64.40	85.80
K61	92.8	96.40	86.10
K63	92.6	97.30	88.10
K65	92.1	96.20	88.50
K67	92.2	96.60	88.50
K69	92.1	95.80	87.40
K75	94.40	93.70	89.50
K77	95.70	93.10	89.20
K79	98.70	98.20	88.80
K81	97.70	98.90	89.50
K91	98.00	94.80	88.30
KK13	83.6	100	90.8
KK17	83.1	99.1	91.7
KKK13	82.5	102	89.9
KKK15	84	99.4	91
M15	84	101	89.9
M19	83.4	99.6	93.5
M29	98.4	99.30	86.50
M31	91.9	101.00	86.10
M33	91.2	100.00	86.3



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M35	94.00	89.70	89.40
M37	91.90	91.50	89.50
M39	92.20	93.50	90.30
M41	92.40	93.50	90.40
M43	101.00	93.40	90.30
M45	100.00	92.20	90.80
M47	98.00	91.50	90.80
M49	98.50	94.00	91.00
M51	100.00	94.90	90.40
M53	98.20	94.80	90.60
M55	98.50	92.10	90.80
M57	100.00	93.50	90.80
M59	98.90	91.70	90.30
M61	93.00	92.10	89.90
M63	92.60	93.70	89.50
M65	92.40	94.00	89.90
M67	93.50	94.00	90.10
M69	93.90	94.20	90.30
M71	94.30	94.50	90.10
M73	94.20	94.70	90.00
M75	96.60	94.80	89.40
M77	98.40	93.90	89.70
M79	99.10	94.00	89.90
MM13	82.7	100	90.4
MM17	84	99.3	91.6
MMM13	81.6	100	91
MMM15	84.1	100	91.2
O15	84.5	100	89.5
O19	83.6	103	92.8
O61	96.00	95.30	90.30
O63	94.40	93.00	89.70
O65	94.80	91.50	90.30
OO13	82.7	100	90.3
OO17	84.1	99.8	91.5
OOO13	82.5	99.6	90.8
OOO15	83.8	100	90.3
Q15	84.1	100	89.8
Q19	83.6	103	93.5
QQ13	82.6	101	90.2
QQ15	84.3	99.3	91.2
QQQ13	82.3	101	90.1
S15	83.8	101	89.9
S17	82.9	99.8	91.9
S19	83.4	101	92.2
SS13	82.5	101	90.6



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SS17	83.6	99.8	91
U17	83.4	100	92
U19	83.1	102	92.6
UU13	82.7	100	90.4
UU17	83.6	100	91.3
W15	82.9	100	90.1
W17	83.4	100	91.9
W19	83.2	101	91.7
WW13	83.4	100	90.6
WW17	83.8	100	91.3
Y15	82.7	100	89.8
Y17	82.7	100	91.2
Y19	82.7	100	91.9
YY13	83.6	101	90.6
YY17	83.6	100	91



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