

6.0 COASTAL DEVELOPMENT SURVEY

6.1 PURPOSE & FORM OF SURVEY

The purpose of the coastal development survey was to assess the influence of development on coastal scenic quality. Officers of the Department for Environment and Heritage indicated that they were particularly concerned about housing subdivisions and to a lesser extent, marinas and wind farms. A number of comments on the completed coastal viewscapes survey expressed concern about developments on the coast and included aquaculture development in the coastal area as well as driving on beaches and placing caravans on the beach (e.g. Farm Beach near Coffin Bay).

The form of development in the future is unlikely to be of low standard shack development, so any shack development used in the survey needed to be of a reasonable standard.

The form of survey was duplicate scenes; a scene which included the development and the identical scene without the development.

The survey covered the following categories:

- Urban type development such as is found on Adelaide's coast – Holdfast Shores, housing development
- Urban type development and subdivisions typical of the coast
- Holiday house/higher standard shack development
- Marina developments
- Aquaculture facilities

These were located in a variety of landscapes, ranging from currently developed through to undeveloped. Scenes were prepared in two ways:

- Scenes which already contain development had this removed, to provide with and without scenes
- Scenes without development had images of development inserted

In both cases, care was taken to ensure that the images were inserted to look realistic and appropriately oriented scaled according to the distance. Similarly where developments were removed from a scene, the land form and land cover were reinstated to appear as similar as possible to the surroundings. Scenes of

development from South Australia as well as from Sydney and the NSW coast were used.



Petrel Cove without development 7.99



Petrel Cove with development 4.72

The development should be obvious in the scene, not obscured, or camouflaged or so distant as to be difficult to identify. Over 70 scenes were prepared providing a total of 146 scenes from which 82 scenes were selected. The set of scenes included two scenes of aquaculture and three scenes of marinas. The scenes are included on the CD.

Table 6.1 indicates the number of scenes by landform and distance to the development.

In addition, this chapter reports on a previous survey conducted by the consultant on the impact of wind farms on scenic quality in coastal areas. This used a similar methodology.

6.2 CONDUCT OF SURVEY

The survey was placed on the Internet and commenced on 11 May 2005. By 23 May there had been only 125 participants and at that rate it would not have achieved the required number of 400 by the end of the month. The survey was therefore placed on the Government's Intranet and participation increased. By the termination of the survey on 31 May, 2413 had participated. A total of 1659 (68.7%) participants completed all 82 scenes and their ratings were used in the analysis of development impacts.

Table 6.1 Scenes for Coastal Development Survey

	Distance to Development		
	Near	Middle	Distant
Headlands			
Low headlands		2	2
Medium headland	2	2	2
High headland	3	1	1
Dunes			
Low dunes	3	2	
Medium dunes	4	1	
High dunes	2	1	1
Pt Augusta – Whyalla shacks	2	2	
Adelaide coast	1	1	1
Total	17	12	7

Coastal Development Survey

This survey is intended to contribute to a study of the scenic attractiveness of South Australia's coast. The outcome of this project will assist State and Local government in better planning and management of the coast.

In this survey you are asked to rate the scenic quality of a range of scenes in which various developments have been inserted. Developments include housing and apartments, marinas and aquaculture. Scenes with and without these developments are included in the survey and will be shown in random order.

Many participants provided comments on their attitudes about coastal development and these constitute a valuable resource from a cross-section of the community. The comments are included verbatim on the CD.

6.3 ANALYSIS OF DATA

Overall Results

The data set was examined for evidence of strategic bias. As scenes with and without development were included, clearly the participant means would not show strategic bias as they did in the coastal survey where mean ratings over 9.5 were rejected. Nor would a mean of say 5 be useful. The standard deviations were also assessed as a possible indicator. Finally the data set was examined for arrays of data 1, 10, 1, 10 ... where the 1 would be the rating for the site with development and the 10 for the same site without development. Only one such participant was found although a number of others came close but with a sufficient range of other ratings to be considered genuine. As

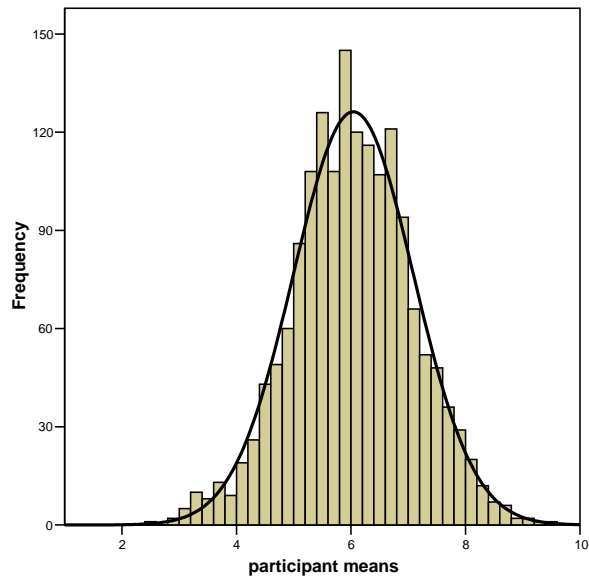


Figure 6.1 Histogram of Participant Means

Normal Q-Q Plot of participant means

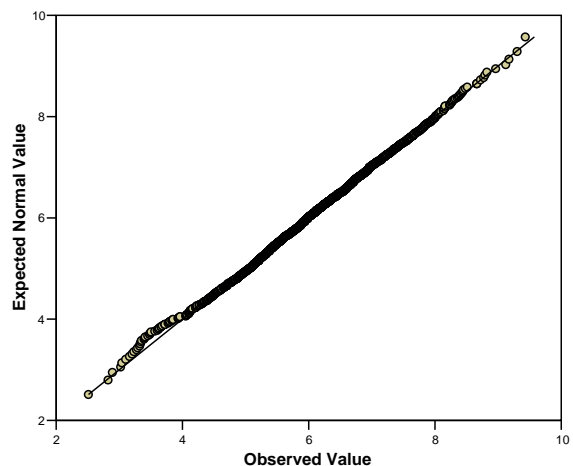


Figure 6.2 QQ Plot of Participant Means

only one participant clearly had strategic bias, it was ignored as its ratings would have negligible effect in a data set of 1659 participants.

Figure 6.1 is the histogram of the mean ratings by the 1659 participants and the QQ plot (Figure 6.2) indicates a very normal distribution. Figure 6.3 is the histogram of the mean ratings of the 82 scenes which suggests a not very normal distribution. However the QQ plot (Figure 6.4) indicates that it is reasonable.

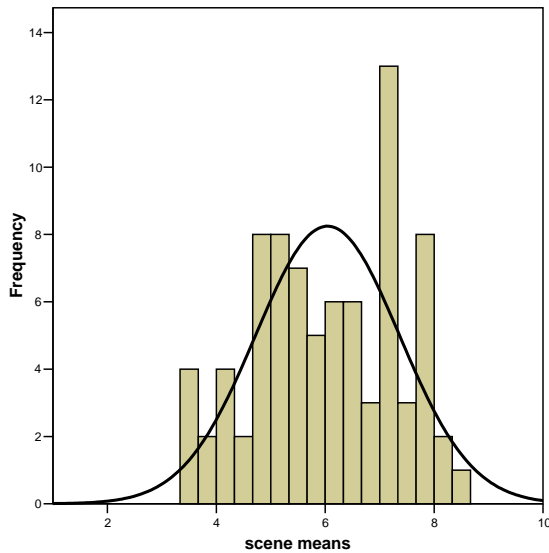


Figure 6.3 Histogram of Scene Means

The overall mean for all scenes without the developments was 7.09 and with development was 5.0, a clear difference of over 2.0. The difference was significant for the overall means: $t = 18.4$, $df = 40$, $p = 0.000$.

Table 6.2 summarises the means for each of the scenes. The Table includes the percentage change in scenic ratings and the highest is a halving of the rating from 7.23 to 3.55 for a scene of low cliffs at Pt Gibbon. The form of development included here was major high rise. The average reduction in scenic quality ratings was 29% but ranged from 10.5% to 50.9%. The differences for each scene were significant, using the paired t test.

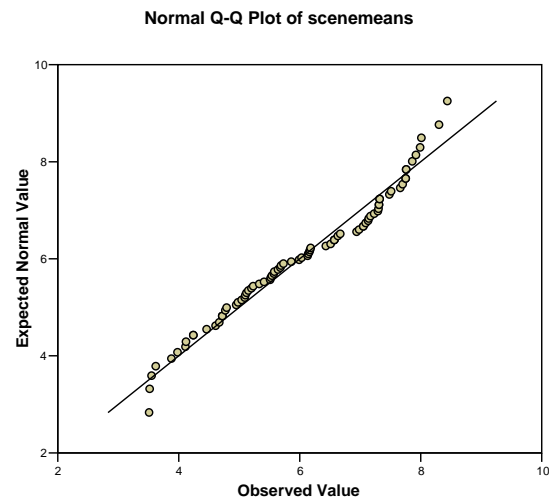


Figure 6.4 QQ Plot of Scene Means

Table 6.2 Ratings of Coastal Development Survey Scenes

Scene	Location	Without development	With development	Difference	% change	p*
SE39	Robe Hooper Beach	7.31	5.33	1.98	27.09	0.000
FP30	Commodore Point, Port Elliot	6.17	5.52	0.65	10.53	0.000
FP74	The Bluff	7.70	5.69	2.01	26.10	0.000
FP97	Petrel Cove & Newland Head	7.99	4.72	3.27	40.93	0.000
FP271	Blowhole Beach	7.66	4.61	3.05	39.82	0.000
FP197	Maslin Beach	7.30	5.54	1.76	24.11	0.000
FP190	Pt Noarlunga south	7.75	5.99	1.76	22.71	0.000
FP176	O'Sullivans Beach 1	7.05	4.72	2.33	33.05	0.000
FP174	O'Sullivans Beach 2	7.48	5.51	1.97	26.34	0.000
Ad49	Holdfast Shores 1	6.18	4.46	1.72	27.83	0.000
Ad52	Holdfast Shores 2	6.14	3.62	2.52	41.04	0.000
Ad71	Henley Beach	5.73	4.79	0.94	16.40	0.000
YP270	James Well	6.43	3.52	2.91	45.26	0.000
YP204	Black Point shacks	6.03	3.88	2.15	35.66	0.000
YP250	North Pt Vincent	7.32	5.41	1.91	26.09	0.000
YP222	Pt Vincent marina	5.58	3.98	1.60	28.67	0.000
SPG89	South Pt Augusta 1	6.51	4.95	1.56	23.96	0.000
SPG102	South Pt Augusta 2	6.13	4.24	1.89	30.83	0.000

Scene	Location	Without development	With development	Difference	% change	p*
SPG113	South Pt Augusta 3	6.94	5.23	1.71	24.64	0.000
SPG150	Pt Lowly fishpods	7.17	5.86	1.31	18.27	0.000
SPG166	Pt Lowly	6.16	3.51	2.65	43.02	0.000
EP448	Pt Gibbon South	7.23	3.55	3.68	50.90	0.000
EP440	Cove nth of Pt Neill	7.05	4.12	2.93	41.56	0.000
EP428	Cove nth of Lipson Cove	7.76	5.2	2.56	32.99	0.000
EP427	North of Lipson Cove	7.14	5.09	2.05	28.71	0.000
EP410	Peake Bay W	8.01	7.09	0.92	11.49	0.000
EP378	Groper Bay	8.44	5.15	3.29	38.98	0.000
EP323	Bay south of Coles Point	8.30	7.32	0.98	11.81	0.000
EP315	South Pt Drummond	7.92	5.10	2.82	35.61	0.000
EP293	Nth end of Sheringa Beach	6.98	4.98	2.00	28.65	0.000
EP270	Waterloo Bay - dunes	7.51	5.12	2.39	31.82	0.000
EP271	Cliff & bay at Elliston	7.75	5.04	2.71	34.97	0.000
EP268	Anxious Bay - beach	7.31	4.67	2.64	36.11	0.000
EP225	E end Venus Bay North	6.57	4.24	2.33	35.46	0.000
EP199	Baird Bay North	7.29	4.72	2.57	35.25	0.000
EP215	Baird Bay	7.13	4.77	2.36	33.10	0.000
EP161	Sceale Bay dunes	6.57	4.11	2.46	37.44	0.000
EP128	Smoky Bay aquaculture	6.67	5.68	0.99	14.84	0.000
EP93	Sandy cove – E. of Laura Bay	7.76	5.64	2.12	27.32	0.000
EP76	Cape Vivonne	6.57	5.57	1.00	15.22	0.000
EP30	Near Fowlers Bay	7.86	6.63	1.23	15.65	0.000
Mean		7.09	5.00	2.09	29.49	0.000

* Paired t test

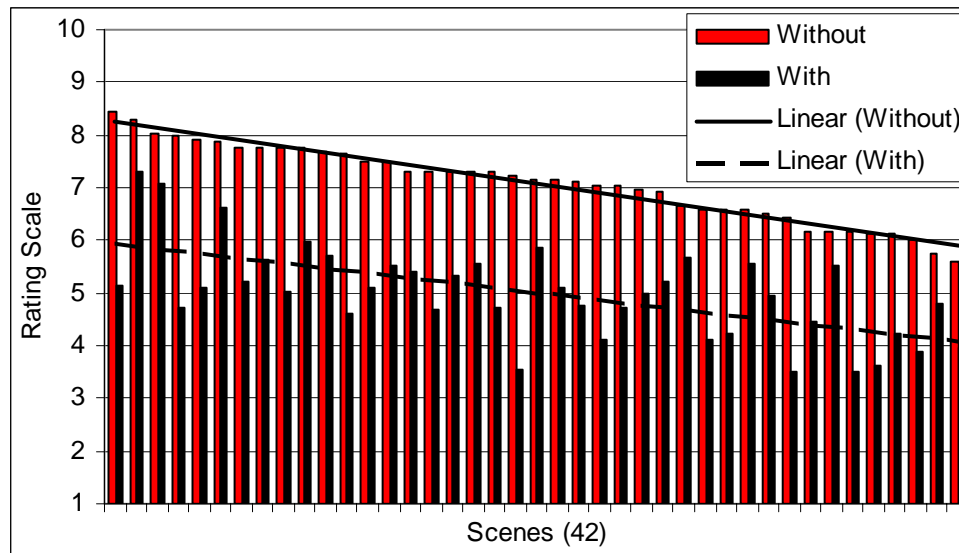


Figure 6.5 Ratings of Scenes Without and With Development
Arranged in descending order of means without development

Figure 6.5 illustrates the impact of development on scenic quality ratings. The data were arranged in descending order of scenic quality ratings to assess whether any relationship is discernible. The impact might be assumed to be greater for scenes of higher scenic quality rating and proportionally lower

for scenes of lesser scenic quality rating. However linear regression analysis indicated near parallel lines of best fit indicating that no such relationship was present. Removing the scenes with marinas and aquaculture from the data set did not change this result.

This finding indicated that the impact of development did not correlate with the level of scenic quality; rather the impact was independent of the particular level of scenic quality and applied uniformly across the range of scenic quality. The decrease in scenic value attributable to development was around two units regardless of whether the scenic quality was eight or four.

This finding is counter-intuitive as it would have been assumed that the impact would be proportionally greater the higher the scenic quality but these results suggest that this is not the case.

This result was based on 42 scenes and while a larger data set may vary it somewhat it is considered unlikely to change it markedly. The strength of the finding suggests that it would not be varied by the inclusion of many more scenes and development examples.

In eight of the scenes the same photograph was used as had been used in the survey of coastal scenic quality. The means of these scenes without development should be similar to those of the original survey. However they were not (Table 6.3). The difference between these averaged 0.88 or nearly 12% and in all scenes, the ratings of the development survey were higher than the original survey. The difference was significant: $t = -4.9$, $df = 7$, $p = 0.0009$.

Table 6.3 Comparison of Ratings of Scenes Common to both Surveys

Description	Original survey	Dev. survey	Diff.	%
Maslin Beach	7.1	7.3	0.2	2.7
Baird Bay	7.08	7.13	0.05	0.7
Sandy cove - E of Laura Bay	7.05	7.76	0.71	9.1
Peake Bay W Cove nth of	6.7	8.01	1.31	16.3
Lipson Cove	6.67	7.76	1.09	14.0
Petrel Cove & Newland Head	6.64	7.99	1.35	16.9
Pt Gibbon S	6.05	7.23	1.18	16.3
Sceale Bay dunes	5.4	6.57	1.17	17.8

Table 6.3 is arranged in descending order of the original survey ratings and interestingly the percentage difference with the development survey increased as the ratings decreased. This indicates close agreement regarding high quality scenes and lower agreement as the

scenic quality decreases – a finding which was noted in the analysis of the original ratings. The fundamental question however remains. Why was there a difference between in the ratings between the two surveys? There are several possible reasons.

Firstly the coastal development survey included no scenes of the wider South Australian landscape to provide a benchmark for the ratings so that they could be taken to represent State-wide ratings. The South Australian scenes contained a far wider range of scenic quality, from gibber plains to the Flinders Ranges whereas the scenes in the coastal development survey comprised a far narrower range. However without the constraint of viewing a wider range of scenic quality, the set of scenes comprised their own context resulting in a spread to higher ratings.

Secondly the coastal development survey contained no scenes of high cliffs, which rated highly, or samphires and mangroves which were at the other end of the scale. Their exclusion made the range of scenic quality even narrower.

Thirdly the coastal development survey contained scenes with and without development whereas the original survey contained no developments in scenes. The mixture may influence ratings of scenes without development – tending to exaggerate the differences, thereby increasing these ratings.

Whatever the reason might be, it is not important that the ratings differed as the results of the coastal development survey stand in their own right. The differences are interesting but do not affect the validity of the results. Although the ratings of the scenes without development should not be taken as necessarily being an accurate measure of scenic quality, they do provide a sound basis for comparing the impact of development on scenic quality.

6.4 DETAILED ANALYSIS

The following tables display the means for a range of options. In all tables, the probability between the two categories - without the development and with the development, was 0.000. In other words, there were significant differences between the two categories for each component. Given the size of the

difference in most cases, it is not surprising that the differences are statistically significant.

Table 6.4 summarises the means for the three forms of development in the survey. The smallest difference was for aquaculture while the differences for housing and marinas were similar. However with only a small number of cases for aquaculture and marinas, these results should not be taken as definitive.

Table 6.4 Means of Different Developments

Development	Without	With	Diff.	%
Housing (36)	7.13	4.98	2.15	30.2
Aquaculture (2)	6.92	5.77	1.15	16.6
Marina (3)	6.70	4.74	1.97	29.3

Using one-way ANOVA on the full data set of differences rather than the averages, the differences between the three forms of development were not significant: $F = 1.93$, $df = 2, 38$, $p = 0.16$.

Thus there was little appreciable difference, certainly none that was statistically significant, in the impact of different forms of development on scenic quality.



Headlands Sheringa Beach 4.98



Dunes Sceale Bay 4.11

Table 6.5 summarises the means for the two landscape units represented in the scenes, headlands and dunes. The average for

headlands was higher than for dunes but the size of the change was larger for dunes; nearly 34% reduction for development on dunes compared with 29% for development on headlands. Again this is partly due to the larger change occurring for scenes of lesser scenic quality. The differences between the two landscape units were not significant: $F = 0.29$, $df = 1, 37$, $p = 0.59$.

Table 6.5 Landscape Units

Landscape unit	Without	With	Diff.	%
Headlands (28)	7.27	5.17	2.1	28.8
Dunes (11)	6.64	4.41	2.2	33.6

Note: excludes aquaculture scenes

Table 6.6 compares the effect that distance to the development had on mean ratings. The difference for the distant scenes was smaller than for the near or middle distant scenes, but the differences were similar for these near or middle distances. The differences in the distances were significant: $F = 5.6$, $df = 2, 36$, $p = 0.008$; due particularly to the smaller difference for the more distant scenes.

Table 6.6 Varying Distance to Development

Distance	Without	With	Diff.	%
Near (3)	6.81	4.46	2.35	34.9
Middle (20)	6.93	4.49	2.43	34.9
Distant (16)	7.36	5.63	1.73	23.4

Note: excludes aquaculture scenes



Shacks, Black Point 3.88



Housing, Pt Lowly 3.51



High rise, Pt Gibbon 3.55

Table 6.7 compares the means for differing forms of development – shacks, housing, and high rise developments. The differences for shacks and high rise were nearly identical while that for housing was lower than for the other two. The differences across the three types of development were not significantly different: $F = 1.78$, $df = 2, 33$, $p = 0.18$.

Table 6.7 Differing Forms of Housing Development

Form	Without	With	Diff.	%
Shacks (3)	6.59	4.02	2.57	39.0
Housing (28)	7.25	5.22	2.03	27.9
High Rise (5)	6.75	4.17	2.58	38.0

Table 6.8 compares the means for scenes in which the development already exists versus those in which the development images have been inserted into the scene to create new developments. There is virtually no difference between the two sets. The differences between the new and existing development were not significant: $F = 0.08$, $df = 2, 34$, $p = 0.77$.

Table 6.8 Existing vs New Development

	Without	With	Diff.	%
Existing development (16)	7.35	5.22	2.13	29.15
New development (20)	7.37	5.18	2.18	29.68

Table 6.9 compares the means for scenes on the basis of how well known the location is to the community. A judgement was made of familiarity for each scene. All the well-known scenes were on the south coast, Noarlunga area and Adelaide beaches. Participants regarded these areas as familiar in the coastal

scenic quality survey. The difference was greater for scenes not well known which is counter-intuitive. It was considered more likely that there would be a greater impact of development perceived for well-known scenes. The differences however on the basis of familiarity were not significant: $F = 2.06$, $df = 2, 34$, $p = 0.16$.

Table 6.9 Familiarity with Scene

	Without	With	Diff.	%
Well known (8)	6.87	5.04	1.83	26.21
Not well known (27)	7.20	4.96	2.24	31.41

6.5 SUMMARY OF COASTAL DEVELOPMENT SURVEY FINDINGS

From this analysis the following conclusions may be derived:

- The differences between scenes with and without development were statistically significant for all groups analysed below.
- The impact of development did not correspond with the level of scenic quality; rather the impact was independent of the particular level of scenic quality and applied uniformly across the range of scenic quality. Thus it cannot be assumed that the higher the level of scenic quality, the greater the impact.
- The largest impact was from housing and marina development while aquaculture appeared to have a lesser impact, however this was based on relatively few aquaculture scenes.
- The impact was similar whether the development was on headlands or dunes.
- While the impact of development was less for the distant scenes, the impact was large for scenes in the near and middle distance.
- The impacts were similar for shack development and high rise development and both were greater than for housing development.
- It made no difference to the impact whether the development was new or existing development had been removed.

- The impact was greater for less well known scenes than for scenes of high familiarity.

The findings regarding the level of impact being independent of the scenic quality rating and also being greater for unfamiliar scenes were surprising as they were contrary to expectations.

6.6 WINDFARM SURVEY

In 2003, the consultant conducted research on the impact of wind farms in both coastal and inland areas of South Australia. The survey included 21 scenes on the coast. The scenes had images of wind farms inserted digitally and scaled in proportion to their distance from the viewer. A total of 311 participants completed the survey.

Overall the presence of wind farms reduced scenic quality rating by 1.52, from 7.61 to 6.09, a significant difference; $t = 14.06$, $df 310$, $p < 0.000$.

More interestingly however the study found that the greatest impact was for scenes of high scenic quality and the impact diminished as scenic quality fell (Figure 6.6).

For inland scenes, which are of a lower scenic quality than that found on the coast, the trend lines actually converged at a

rating of 5.1. In scenes below 5.1, the presence of a wind farm could enhance scenic quality.



Mt. Westall with wind farm. Rating 6.63

However on the coast, in all scenes the presence of the wind farm diminished scenic quality. The two trend lines can be used to predict the likely impact of a wind farm on scenic quality of a given rating (Table 6.10).

Table 6.10 Predicted Effect of Wind farm on Coastal Scenic Quality

Rating without wind farm	Rating with wind farm	Difference
8.5	6.51	-1.99
8.0	6.24	-1.76
7.5	5.97	-1.53
7.0	5.71	-1.29
6.5	5.44	-1.06
6.0	5.17	-0.83

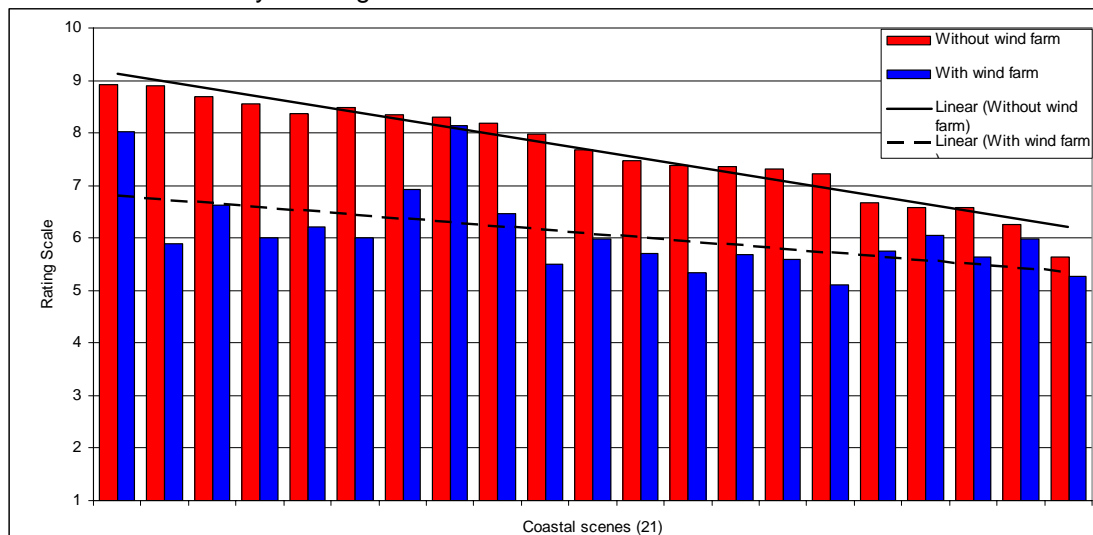


Figure 6.6 Impact of Wind Farms on Coastal Scenic Quality