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Review of the Australian Flood Studies Database

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by

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Photo on front cover
Aerial view of the flooding in Lismore, New South Wales, June 2005
Photo courtesy: NSW SES/Phil Campbell.

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Executive Summary

With the average annual cost of floods estimated at $377 million, floods are Australia's most expensive natural hazard. As a result, considerable expenditure is made by government and industry to define flood areas in an effort to reduce the impacts of floods. This work typically involves the creation of reports describing the methodology used, data sources and results of hydrological and hydraulic modelling and damage assessments. While numerous reports are developed each year, there was no centralised record of what studies had been undertaken in Australia at a state/territory or national level until the development of the Australian Flood Studies Database in 2004.

In 2009 Geoscience Australia reviewed the Australian Floods Studies Database via an online questionnaire. Opinion of the database was sought in three key areas including database functionality and content, and updating the database. The respondents confirmed the usefulness of the existing database content including hydrology and hydraulic scenarios, historical flood events used in the calibration, terrain and floor level surveys, damage assessments, inundation and hazard scenarios, information on what has occurred since a study's completion and related studies. Recurring themes highlighted by the survey respondents include the ability to be able to access the flood study reports and GIS flood layers via the database and be able to input data. Over 170 people completed the survey; 90% of whom were from local government. While only 20% of respondents had used the database, 72% of all respondents to the survey indicated that they would use the database in the future, whether or not they had used the database in the past.

Three main recommendations can be concluded from the survey responses. The first recommendation is that the Australian Flood Studies Database is updated and that the lead agency for floodplain management in each State/Territory be responsible for that update on at least an annual basis. The second recommendation is that the database's existing functionality and content is maintained and further enhanced. The final recommendation is that the database is further publicised.

1. Background

With the average annual cost of floods estimated at $377 million[1], floods are Australia's most expensive natural hazard. This is significant, particularly considering that anecdotal evidence suggests that the costs of floods may be much larger than that recorded officially.

While some areas of Australia experience flooding relatively frequently such as towns on the New South Wales north coast, floods occur infrequently in other areas of Australia. In areas where floods occur rarely, the community is generally poorly prepared when a flood occurs; and express both surprise and anger at the resulting flood impacts. Even where floods have been experienced, they are relatively small events, particularly when compared to the likely impacts which could be expected during a probable maximum flood[2] or other extreme event.

The impact of floods can be reduced. Notably, flood risk is more manageable than the risk from other natural hazards as floods are limited to definable areas[3]. In an effort to reduce the impacts of floods, considerable expenditure is made by all levels of government and industry to define the areas affected by flood hazard and identify the risk for a range of small and frequent, to extreme and rare scenarios. This work typically involves hydrological and hydraulic modelling and an assessment of the exposure and vulnerability of the impacted populations. A report, or series of reports, describes the methodology used, data sources and documents the key results.

The development of the Australian Flood Studies Database in 2004 centralised information on flood study reports for the first time. Prior to the development of this database, there was no centralised record of what studies had been undertaken in Australia even at a state/territory level. Following the establishment of the Australian Flood Studies Database some state based databases have been developed and the Insurance Council of Australia has developed a National Flood Information Database. The insurance database houses information on flood depths by street address for a number of scenarios but is not publically available.

1.1. DATABASE DEVELOPMENT

In 2003 Geoscience Australia began the development of the Australian Flood Studies Database as part of the Natural Disasters Mitigation Programme administered by the then Australian Government Department of Transport and Regional Services. The database was developed to address some of the issues identified in the Council of Australian Government's (COAG) review of natural disasters[4], in particular relating to consistency in data collection and risk assessment.

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[1] Bureau of Infrastructure, Transport and Regional Economics (BITRE) analysis of the Emergency Management Australia database, Table 30, pp. 44, published in BITRE, 2008. *About Australia's Regions,* Department of Infrastructure, Transport, Regional Development and Local Government, Australian Government, Canberra.

[2] A probable maximum flood is the largest flood possible. It is often assigned an annual exceedance probability of between 0.01% and 0.00001%. Nathan, R. J. and Weinmann, P. E., 1999. Estimation of Large to Extreme Floods, *Australian Rainfall and Runoff – A Guide to Flood Estimation,* Volume 1, Book VI, Institute of Engineers, Australia.

[3] Middelmann, M. H. 2007. *Natural Hazards in Australia: Identifying Risk Analysis Requirements,* Geoscience Australia, Canberra.

[4] COAG, 2004. *Natural Disasters in Australia. Reforming Mitigation, Relief and Recovery Arrangements.* A report to the Council of Australian Governments by a high level officials' group, August 2002, Department of Transport and Regional Services, Canberra.

Database fields were developed to capture information such as the techniques and scenarios used in each study, the data available, and the data and report custodian. The database fields were divided into ten categories including hydrology and hydraulic scenarios, terrain and floor level surveys, inundation and hazard scenarios, damage assessments, historical flood events used in the calibration, related studies, and information on what has occurred since a study's completion.

The scope of the database was limited to reports on riverine flood studies, completed post 1979. Therefore, studies primarily modelling the impact of storm surge, tsunami, dam failure or stormwater were not included. No new flood studies have been added to the database since the completion of the large initial data collection exercise in mid 2004.

In 2005 a paper was presented on the database at the New South Wales Floodplain Management Conference[5]. The paper and presentation described the attributes stored in the database, drew several conclusions from the data and made a number of recommendations relating to the future analysis of flood risk nationally. Following requests from local government at that conference to make the database publically available, significant work was undertaken by the Australian Government on the original database structure to enable open access via Geoscience Australia's website in 2006[6].

Informal feedback on the database by users prior to the review was that the database is invaluable for learning from the work undertaken by other Councils. For example, a Council indicated that it was useful to see what methods, models and outputs were used in flood studies for other local government areas prior to commissioning a flood study of their own. At a national scale the database has assisted in identifying popular models used during the time period; and highlighted the huge variation between study methodologies for analysing risk[5]. The database has also been used as a tool to aid comparisons of relative risk between urban centres including contributing to knowledge of the number of floodprone buildings in Australia[7].

1.2. REVIEW OF DATABASE

In 2008 Geoscience Australia instigated a formal review of the database, the results of which are described in this document. The review's primary aim was to determine whether there is a continued need for the database. If a continued need for the database was confirmed by the questionnaire responses, then the questionnaire responses would be used to achieve the following objectives:

- Ensure a user friendly database
- Identify the most practical method for updating the database
- Identify and prioritise database content
- Identify and prioritise database functionality.

An online questionnaire[8] was developed and deployed on Geoscience Australia's website in mid January 2009 until early March 2009. The use of a web based survey over a paper survey had several advantages including improved ease of navigation and associated reduced survey time for respondents, and the ability for Geoscience Australia to regularly monitor survey responses.

In order to publicise the survey, a letter was sent to every Mayor in Australia inviting their council to participate in the review, regardless of whether riverine flood was likely to be an issue for that Council. The survey was also promoted through Engineers Australia, the newsletter Floodplain

[5] Middelmann, M., Sheehan, D., Jordon, P., Zoppou, C., & Druery, C., 2005. National Catalogue of Flood Studies. *NSW Floodplain Management Conference*, 22-25 February 2005, Narooma.

[6] **http://webmap.ga.gov.au/imf-natural_hazards/imf.jsp?site=natural_hazards_flood**

[7] Leigh, R. & Gissing, A., 2006. How Many Floodprone Properties are there in Australia? *NSW Floodplain Management Conference*, 28 February to 2 March 2006, Lismore.

[8] **http://webmap.ga.gov.au/flood-survey**

Manager, the Floodplain Management Authorities, the New South Wales/Victorian Floodplain Management Conference and the National Flood Risk Advisory Group. As no email contact list of engineering consultants could be obtained, councils were asked to promote the survey to any consultants that they used.

2. Summary of Key Results

The key results from the questionnaire are summarised in this section. The survey questions are documented in Appendix 1, along with the summarised responses. This section, like the survey, is divided into five parts:

- About the respondents
- Usage of the database and functionality
- Content
- Updating the database
- Final comments.

2.1. ABOUT THE RESPONDENTS

The survey was completed by 173 people. Of these, 90% of responses were from local government, reflecting approximately one third of Councils in Australia. The response rate from consultants was low, at 3% of total responses received. Of the total respondents to the survey, half were involved in managing or implementing programmes, 24% in policy development, and 20% in modelling and research.

2.2. USAGE OF THE DATABASE AND FUNCTIONALITY

Only 20% or 34 respondents had used the database. Of those, half (i.e. 17) had only used the database once, 35% had used it several times a year, and 15% stated that they had used the database once a month. About 70% (or 125) of all respondents to the survey indicated that they would use the database in the future, whether or not they had used the database in the past.

Database users were asked to indicate what they liked about the existing database from a number of options. Over 90% of people who had used the database (i.e. 31 users) indicated that they liked the database as it enabled the user to see from the one location what flood studies have been undertaken nationally. Over 70% of users liked the ability to search for studies undertaken in a particular area.

About 30% of users (i.e. 10 people) indicated that they wanted some change in functionality in the database. The recurring themes included the ability to:

- Access the documents, for example, via PDF
- Access the GIS flood layers
- Input data.

2.3. CONTENT

Respondents to the content section were those who indicated their intention to use the database in the future, equating to 125 people. This included those who had previously used the database and those who intended to use the database now that they were aware of it. Respondents were invited to indicate which of the ten categories they found or would find useful. The categories included:

- Hydrology scenarios
- Terrain surveys
- Hydraulic scenarios

- Historical flood events used in the calibration
- Inundation scenarios
- Hazard scenarios
- Floor level surveys
- Damage assessments
- Information on what has occurred since a study's completion
- Related studies.

All categories were considered useful by the vast majority of respondents, with the percentage of positive responses ranging between 85% and 93% depending on the category.

Respondents were shown an example taken from the database of each category and asked a question(s) about the database fields related to that category. Respondents were asked whether there were any fields that they thought needed modification and/or any new fields that they would like to see added. Generally respondents were happy with the existing fields, with, on average, less than 10% suggesting either modifications to existing fields or new fields.

Of the suggested changes, some survey responders suggested information that was overly detailed for a national database. Others requested information that is unlikely to be contained in the majority of reports. The suggestions that could be reasonably considered within the context of a national database are summarised in the following two sub sections.

2.3.1. Suggested modification of existing fields

A number of respondents made suggestions relating to the modification of existing database fields. The key suggestions are summarised below.

- Increase flexibility of searches. For example, provide the ability to search by local government or town in addition to searching by state or stream as is currently available
- Include the information on floods used for calibration with information on the hydrology and hydraulic modelling
- Consolidate the average recurrence interval (ARI) scenario information where the information does not vary between scenarios to remove repetitiveness
- Provide explanations of the headings, for example, ARI scenario
- Increase the prominence of the 'Custodian' field.

2.3.2. Suggested additions of new fields

A number of new fields were suggested by the survey respondents. Table 1 highlights the key suggestions made and provides a brief justification for considering their inclusion in the database.

Table 1: Summary of key new fields suggested by survey respondents and justification for their inclusion in the database.

SUGGESTED NEW FIELDS	JUSTIFICATION
Year that the modelling, survey, mapping, assessment etc. were undertaken.	The final report may not be released for many years after the completion of the modelling etc; therefore, the report date may not be a good indicator of the age of the model/survey.
Version number of the software models used.	There is considerable change in functionality between some models; therefore, the version number can be used to indicate the capabilities of the particular model used in the study.
Estimated average recurrence interval of floods used in calibration.	The estimated recurrence interval is useful for better understanding the study and to ascertain what data is available for future studies.
Information on climate change impacts and/or scenarios.	The number of studies which consider climate change continue to increase and information relating to the scenarios considered, etc. would be useful.
Medium of survey information (e.g. 12d, ascii, DEM, xyzs).	This would make a useful addition to format of survey.
Breakdown of estimated damages by type (e.g. residential, commercial, industrial, critical infrastructure, rural) when calculating losses.	As more studies consider risk and get more sophisticated in what they consider, this will become increasingly relevant.
Include draft reports and a field on the status of the report (e.g. draft, final).	Many reports are not formally endorsed and therefore may never enter the database as a 'final' report, though they are in use by council.
Include the actual studies in the database, for example, as PDF (portable document format) files.	The reports can be difficult to access and this would enable database users interested in obtaining more detailed information about a particular report the ability to quickly find it, if it is available from the report.

A number of suggestions for additional fields are made in Table 1. However, if reports were included in the database then the addition of these other fields would be unnecessary as they could be obtained directly from the corresponding report, if available.

2.3.3. Updating the database

Ninety percent of identified future users indicated that they would like to see the database updated, equating to 112 responses. Respondents indicated a preference for the database to be frequently updated. More specifically, 42% (47) of people wanted the database to be updated on the completion of each study. Over 30% of people indicated that they thought that the database should be updated annually. Biannual updates were the third most preferred option at 13%.

Those respondents who indicated that they wanted the database updated (i.e. 112) were asked to rate the chance of success (i.e. low, medium or high) of using a range of mechanisms to update the database. Overall, respondents rated updating of the database by the lead state/territory government agency responsible for floodplain management as having the highest chance of success, with 52% of all respondents to this question choosing 'high' and 37% of respondents choosing 'medium' for this option.

Only 5% of respondents indicated that they had any other ideas or comments related to updating the database. Several respondents suggested that there should be more publicity for the database. This is

supported by the number of people who didn't know about the database, but once made aware of it, want it to be updated.

2.3.4. Final comments

Only 4% of respondents took the opportunity to provide any final comments on the database. One of these suggestions was to expand the database to include other types of inundation studies, for example, coastal inundation due to storm surge and/or tsunami, groundwater flooding and flash flooding. Another suggestion was to provide a link to the flood mapping pages of councils, where they exist.

3. Recommendations

There are three main recommendations arising out of the review of the Australian Flood Studies Database. They include that:

1. The Australian Flood Studies Database is updated and that the lead agency for floodplain management in each State/Territory assumes responsibility for the update on at least an annual basis.
2. The database's existing functionality and content is maintained and further enhanced.
3. The database is further publicised.

3.1. DISCUSSION OF THE RECOMMENDATIONS

Recommendation one is that the database is updated and that the lead agency for floodplain management in each State/Territory assumes responsibility for the update on at least an annual basis. This recommendation requires the cooperation of all three levels of government. While the findings of the review support the view that state governments have the highest chance of successfully updating the database, much of the data is held at local government level; therefore, cooperation between these two levels of government is vital. Equally important however is an effective relationship between these levels of government and the Australian Government as the database's custodian.

The most efficient method for inputting data into the database would be via a web-based data entry tool. The data entry tool would need to be password protected to protect the integrity of the information entered. A web based data entry tool would enable registered users to modify information in the database, including:

- Create new records
- Update existing records
- Delete existing records
- Upload attachments.

A web-based data entry tool would enable registered users anywhere to directly enter data electronically into the database and remove the need for specialised software for data entry by those users. It would also enable immediate access of new or modified data to the database custodian to undertake nominal quality control/quality assurance processes before making the updated data accessible to the general public. Restrictions could be imposed on data entry, for example, an agency in one state would only be granted privileges to update the data within their state.

Each state and territory has adopted different policies and processes for floodplain management. Therefore, the actual process of updating the database may vary between the jurisdictions. For some jurisdictions, data entry may be more effective if delegated to the local government level, although

responsibility for facilitating the update would still lie with the relevant state government agency. The provision of an 'opt out' system, where a local government feels strongly against having their data included, could be made available. Regardless of the process, continued local government support is vital, to ensure the accuracy and currency of the database.

While over 1000 studies exist in the current database, gaps exist where information could not be obtained at the time of data collection. Close consultation between state/territory governments and local councils, catchment management authorities and other relevant groups, will assist in filling these gaps.

The second recommendation relates to the maintenance and further enhancement of the existing database. The survey respondents strongly supported the continued maintenance of the database's existing content and functionality. Moreover, suggestions were made for database enhancements, in particular, additional summarised content fields (summarised in section 2.3.2). Of the suggested changes, the inclusion of a PDF of each report was the most frequently made recommendation. The addition of the reports would enable database users interested in obtaining more detailed information about a particular report the ability to quickly find it, if it is available in the report and would involve minimal changes to the existing database.

The third and final recommendation is that the database is further publicised. Analysis of the survey results showed that only 20% of respondents had used the database before, although 72% indicated that now that they were aware of it, they would use the database in the future. This indicates a need for greater publicity of the database.

In early 2009, a letter was sent to every local government inviting them to contribute to the review, the primary aim of which was to determine whether there was a continued need for the database. The key results of that review should be articulated back to local government and this publication made available to the general public through the internet. As indicated earlier, the support of local government is vital to the update and effectiveness of the national database, therefore, engaging them in the process is important.

Other options for further publicising the database include promotion of the database through groups such as the Floodplain Management Authorities, the Institute of Public Works Engineers Australia and the National Flood Risk Advisory Group. State governments will play a pivotal role in working with councils, catchment management authorities and other groups in updating the database. The newsletter Floodplain Manager is one mechanism for reaching a broader audience who may find useful, but not be directly involved in the update of the database.

3.2. FUTURE PLANS

The Australian Government through the database's custodian Geoscience Australia has indicated that it will commit to developing a password protected data entry tool for the database following the positive results of the database survey. Broad guidelines are required for updating the database and these will be thoroughly scoped in early 2010 in consultation with key stakeholders. Such guidelines however are likely to include the need to provide a justification for data modification at the time of submitting the change[9].

[9] For example, where the change is the modification of an existing record in the database, a reason for that modification must be supplied, for example, 'inaccurate data entered'. Where the change is for the deletion of an existing record, an example justification given could be 'draft version has been superseded by the final version X, which is included in the database as study number Y'.

The review has identified the inclusion of PDFs of reports in the database as a high priority. This was confirmed at the July meeting of the National Flood Risk Advisory Group who have committed to work with the Australian Government through Geoscience Australia on the update and enhancement of the Australian Flood Studies Database. With whole of government support; this addition to the database will be implemented. Other enhancements will be prioritised and implemented where possible.

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Appendix 1. Review Questions and Results

The online questionnaire was divided into sections A to E and included:

- Section A – About you / your agency
- Section B – Usage and functionality
- Section C – Content
- Section D – Updating the database
- Section E – Final comments.

The review questions and summarised questionnaire results are documented in Tables 2 to 6.

Table 2: Section A – About you / your agency

QUESTIONS	NUMBER OF RESPONSES	PERCENTAGE
1. Where are you from?	**173**	**100**
a. Local government	156	90
b. State government	9	5
c. Federal Government	0	0
d. Consultant	5	3
e. Insurance industry	1	1
f. Other (please specify)	2	1
2. From what perspective would you describe your interest in the database?	**173**	**100**
a. Modelling or research	34	20
b. Policy development	41	24
c. Management or programme implementation	84	49
d. Other (please specify)	14	8

Table 3: Section B – Usage and functionality

QUESTIONS	NUMBER OF RESPONSES	PERCENTAGE
1. Have you used the database?	**173**	**100**
a. Yes	34	20
b. No (go to B.5)	139	80
2. On average, how frequently do you use the database?	**34**	**100**
a. Only used once	17	50
b. Several times a year	12	35
c. Once a month	5	15
d. Twice a month	0	0
e. Once a week	0	0
f. Several times a week	0	0
3. What do you like about the existing database? More than one response may be selected.	**34**	**100**
a. Comprehensive fields including information on hazard, risk, data sources and data/report custodians.	12	35
b. Ability to see what flood studies have been undertaken nationally from the one location.	31	91
c. Ability to query metadata on the studies via the internet.	10	29

d. Ability to search for studies undertaken in a particular area.	25	74
e. Ability to search by category.	10	29
f. Other (please specify).	0	0
4. Are there changes in functionality that you would like to see in the database?	**34**	**100**
a. Yes	10	29
b. No	24	71
5. Are you likely to use the database in the future?	**173**	**100**
a. Yes	125	72
b. No (go to section E)	48	28

Table 4: Section C – Content

QUESTIONS	NUMBER OF RESPONSES	PERCENTAGE
1. Do you find useful the information on hydrology scenarios?	**125**	**100**
a. Yes	106	85
b. No (go C.3)	19	15
2. Are there any fields that you think need modification and/or any new fields related to hydrology scenarios that you would like to see added?	**106**	**100**
a. Yes	12	11
b. No	94	89
3. Do you find useful the information on terrain surveys?	**125**	**100**
a. Yes	109	87
b. No (go C.5)	16	13
4. Are there any fields related to terrain surveys that you think need modification and/or any new fields that you would like to see added?	**109**	**100**
a. Yes	13	12
b. No	96	88
5. Do you find useful the information on hydraulic scenarios?	**125**	**100**
a. Yes	109	87
b. No (go C.7)	16	13
6. Are there any fields that you think need modification and/or any new fields related to hydraulic scenarios that you would like to see added?	**109**	**100**
a. Yes	10	9
b. No	99	91
7. Do you find it useful knowing which historical flood events were used for the calibration of the hydraulic model?	**125**	**100**
a. Yes	115	92
b. No (go C.9)	10	8
8. Are there any fields that you think need modification and/or any new fields related to historical events that you would like to see added?	**116**	**100**
a. Yes	3	3

b. No	113	97
9. Do you find useful information on the inundation scenarios that have been mapped?	**125**	**100**
a. Yes	116	93
b. No (go C.11)	9	7
10. Are there any fields that you think need modification and/or any new fields related to inundation scenarios that you would like to see added?	**116**	**100**
a. Yes	3	3
b. No	113	97
11. Do you find useful information on the hazard scenarios that have been mapped?	**125**	**100**
a. Yes	115	92
b. No (go C.13)	10	8
12. Are there any fields that you think need modification and/or any new fields related to hazard scenarios that you would like to see added?	**115**	**100**
a. Yes	11	10
b. No	104	90
13. Do you find useful the information on floor level surveys?	**125**	**100**
a. Yes	112	90
b. No (go C.15)	13	10
14. Are there any fields that you think need modification and/or any new fields related to floor level surveys that you would like to see added?	**112**	**100**
a. Yes	13	12
b. No	99	88
15. Do you find useful information on the damage assessments undertaken?	**125**	**100**
a. Yes	112	90
b. No (go C.17)	13	10
16. Are there any fields that you think need modification and/or any new fields related to damage assessment that you would like to see added?	**112**	**100**
a. Yes	13	12
b. No	99	88
17. Do you find useful information on what has occurred since a study's completion? For example, information on whether a flood study resulted in modifications to the local planning scheme.	**125**	**100**
a. Yes	114	91
b. No (go C.19)	11	9
18. Are there any fields that you think need modification and/or any new fields related to post flood information that you would like to see added?	**114**	**100**
a. Yes	9	8
b. No	103	92
19. Do you find useful information on what other studies relate to the study that you are looking at?	**125**	**100**
a. Yes	113	90

b. No (go C.21)		12	10
20. Are there any fields that you think need modification and/or any new fields that you would like to see added?		**113**	**100**
a. Yes		5	4
b. No		108	96
21. Do you have any further comments that you would like to make on the content of the database? For example are there additional categories that you would like to see added to the database?		**125**	**100**
a. Yes		13	10
b. No		108	90

Table 5: Section D – Updating the database

QUESTIONS		NUMBER OF RESPONSES	PERCENTAGE
1. Would you like to see the database updated?		**125**	**100**
a. Yes		112	90
b. No (go to section E)		13	10
2. How frequently do you think that the database should be updated?		**112**	**100**
a. On completion of each study		47	42
b. Annually		36	32
c. Biannually		15	13
d. Every three years		9	8
e. Every four years		1	1
f. Every five years		4	4
3. How do you rate the chance of success of using the following mechanisms for updating the database? Please consider aspects such as timeliness of input and completeness of the database. Assume that data could be entered directly into the database (e.g. via the web).		**112**	**100**
a. Updated by the study's lead author (e.g. consultant, local government)	High	27	24
	Medium	58	52
	Low	27	24
b. Updated by the study's lead commissioning organisation (e.g. local/state/territory government)	High	30	27
	Medium	57	51
	Low	25	22
c. Updated by the lead state/territory government agency responsible for floodplain management	High	58	52
	Medium	41	37
	Low	13	12
d. Updated by the Australian Government (e.g. via a consultant)	High	40	36
	Medium	43	38
	Low	29	26
e. Database made interoperable with databases developed and maintained by state/territory governments.	High	15	13
	Medium	36	50
	Low	41	37
4. Do you have any other ideas or comments on updating the database?		**117**	**100**
a. Yes		6	5
b. No		111	95

Table 6: Section E – Final comments

QUESTIONS	NUMBER OF RESPONSES	PERCENTAGE
1. Would you like to provide any additional comments regarding the database?	**173**	**100**
a. Yes	7	4
b. No	166	96
2. Are you happy to be contacted in the event that any further information or clarification is required?	**173**	**100**
a. Yes	96	56
b. No	77	45