# RISK ANALYSIS OF PUBLIC PRIVATE PARTNERSHIPS IN THE DEVELOPMENT OF NEW SCHOOLS IN NEW ZEALAND

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# ABSTRACT

The following report has been compiled for Industry Project, a paper within Unitec's Bachelor of Construction (CM). This report intends to evaluate the influence of risk in the procurement of a new school in New Zealand under a Public Private Partnership. Senior Unitec Lecturer Roger Birchmore will be supervising and grading this report.

# CONFIDENTIALITY STATEMENT

The author notes that no commercially sensitive or confidential material has been used and that no correspondence or interactions with any contractor or member of a Government Department has taken place in the creation of this report. Publically accessible documents and literature has been used in all facets of this report.

# PUBLICATION AGREEMENT

I agree that the Unitec Library and Department of Construction may make a hard copy or digital copy of this thesis available for the purposes of research or private study, provided that due acknowledgement is made where appropriate and that the author's permission is obtained before any material from this thesis is published.

# ACKNOWLEDGMENTS

I wish to thank my supervisor Roger Birchmore for having the patience as I bounced from issue to problem; your assistance is much appreciated.

I also wish to thank my wife and family for spending countless hours reading through this report and spending lonely weekends while I researched this topic.

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# GLOSSARY

**Five Year Agreement (5YA):** An agreement of funding for maintenance and associated costs between a School and the Ministry of Education based on the school Gross Floor Area.

**Net Present Cots (NPC):** The expected whole-of-life cost to the Government of the Reference Project. (Victoria Partnership 2001)

**Private Funded Initiative (PFI):** A form of a Public Private Partnership used to procure private funds to develop and run an infrastructure project.

**Public Private Partnership (PPP):** "Any medium-to-long term relationship between the public and private sectors, involving the sharing of risks and rewards of multisector skills, expertise and finance to deliver desired policy outcomes". (Standard and Poor's).

**Service Payment:** The cost/price that the Public Sector pays to a consortium (on a regular basis) for the construction and operation of an asset over the life of the contract.

# LIST OF ABBREVIATIONS

| | |
|---|---|
| **5YA** | Five Year Agreement |
| **BSF** | Building Schools for the Future |
| **DBH** | Department of Building and Housing |
| **MOE** | Ministry of Education |
| **NAO** | National Auditing Office |
| **NPC** | Net Present Cost |
| **NSW** | New South Wales |
| **NZ** | New Zealand |
| **NZCID** | New Zealand Council for Infrastructure Development |
| **PFI** | Private Funded Initiative |
| **PFP** | Privately Financed Project |
| **PPP** | Public Private Partnership |
| **PSC** | Public Sector Comparator |
| **ROI** | Registrations of Interest |
| **UK** | United Kingdom |
| **VFM** | Value for Money |

# 1. INTRODUCTION

## 1.1. Background

Research for this project started in February of 2010. At that time the author was aware that the New Zealand Government and especially the Ministry of Education had been investigating the use of Public Private Partnership procurement in their property portfolio. Subsequent research investigated this form of procurement and the author's Literature Review and Methodology was developed around the idea of analysing risks through Qualitative discussions with construction companies and professionals linked to Education construction in the Auckland area.

In June of 2010, the author's employer was engaged by a Government Department as a Consultant to advise on Public Private Partnership related issues. As part of the engagement the author was required to sign a confidentiality statement which included the requirement not to discuss Public Private Partnership procurement with any building contractors or the like. For this reason, the author considered it inappropriate to discuss any of this research or use resources from either contractors or Government personnel. It must be specifically noted that the following report has been developed using only nationally and internationally published literature. Unless acknowledged, all tables and spreadsheets included within this report have been developed by the author.

## 1.2. Introduction

The idea of a contractor and client aligning themselves for the better good of a project is a common concept in the New Zealand construction industry. Most

construction companies now include words such as ‘your partner’ or ‘building relationships’ in their corporate marketing to evoke the idea of creating relationships with potential clients. The latest initiative to enter the New Zealand construction industry is the Public Private Partnership (PPP), where a contractor/consortium and the Government enter into a contract to construct a public entity.

In the past 10 years the Ministry of Education has undertaken a revitalised construction programme not seen in decades. In the Auckland area, the Ministry of Education has constructed five new schools and is planning for a minimum of ten more. In 2007, the Ministry of Education instigated the ‘Single Line Accountability’ model for the construction of new schools. This method requires a ‘Consortium’ to construct a school on a Guaranteed Maximum Price basis. This method allows the Ministry of Education to fund a new build and shift the design, construction and budgetary risk to the Consortium.

In December 2009 the Minister of Education, the Hon Anne Tolley, issued a press release identifying that the Ministry of Education was considering the possibility of procuring new schools on a PPP basis. Mrs Tolley indicated that the focus was on “teaching and learning, and delivering better value for taxpayers”. In August 2010 the Ministry advertised consultant and advisor positions to prepare the second round business case for a proposed new school in the North Island.

It is widely published by both the United Kingdom and Australian Governments the criteria to be undertaken in developing a PPP ‘Business Case”. Part of this analysis is the development of a Public Sector Comparator that evaluates the costs and risks of a hypothetical project against the Service Payments tendered by a consortium.

The New Zealand Government however, has published little information to date and the information that is published appears to take direction from overseas methods.

This report intends to use literature to research Public Private Partnership risk factors and their links to the development of a Public Sector Comparator.

## 1.3. RESEARCH JUSTIFICATION/RATIONALE

Since 2007, the author has been representing the Ministry of Education in the role of Ministry of Education (Client) Representative to the Consortium, on the construction of new schools in the Auckland and Bay of Plenty areas. The author's role often extends to providing the Ministry of Education with contract, budget, building condition and site suitability advice, as well as assessments for Board of Trustee projects, Special Schools and Te Kura Kaupaupa o Maori schools.

The company the author is employed by has assisted the Ministry of Education in developing many of the procurement models it now uses, for example the 'single line accountability model'. This model allows the Ministry of Education to concentrate on setting up the learning environment rather than having to make design decisions or dealing with programme or budget issues. In simple terms, the Ministry of Education provides a predetermined build budget, design parameters and a completion date, and the Consortium agrees to deliver the project within these constraints.

The idea of a PPP is possibly seen by the Government as shifting the risk of design, funding and then maintenance of a project, to the Consortium, who are procured to design, build, fund and maintain a new building and in return are paid an annual sum, called a Service Payment, for the duration of the contract,

i.e. 25 years, after which time the Consortium hands the building over to the Government.

It is anticipated that this document will aid the author's employer in identifying risks and assess a project that is earmarked for being procured under a PPP contract. The author also expects that the findings of this report could potentially assist the Ministry of Education in determining a preferred procurement model for the construction of their new schools programme.

## 1.4. PROPOSED RESEARCH QUESTION

How does the evaluation of risk influence the project value of a Public Private Partnership – A case study of risk using a Public Sector Comparator for an education project.

## 1.5. RESEARCH OBJECTIVES

This research is attempting to assess risk in terms of cost by developing a Public Sector Comparator for a hypothetical secondary school. This school will be based on the Ministry of Education's publically published criteria and calculator of project costs.

The aim is to use literature to identify risk, which will be inserted and valued in a Risk Matrix. This value of risk will then be added into a developed Public Sector Comparator that will under go a series of assessments to identify what the affect of reallocating and altering the impact of risk has on the project value.

## 1.6. RESEARCH DESIGN AND METHODS

As noted previously, this research will be based on published material to determine risk. In not discussing risk with contractors/consortia, the potential problem is that the author's assumptions or perceptions could influence the apportionment or value of risk. The author has determined that by using a variety of published material in a Quantitative study a balanced report can be produced. The following will be used to develop this report.

Literature Review

- The investigation of current literature both from national and international sources will be used to and give an overview of the history of PPP procurement and to illustrate their intricacies.

Methodology

- Risks identified within the Literature Review will be tabulated to determine which risks appear most often. The top ten risks will be recorded and used in the further development of the report.
- A hypothetical school project will be developed from the standard Ministry of Education parameters.
- A Public Sector Comparator will be created for this hypothetical project and the identified risks will be valued and assessed.

The data analysis of this report will take the form of a case study. It is intended that this report will follow Journal articles by Chan, A. P. C., Lam, P. T. I., Chan, D. W. M., Cheung, E. and Ke, Y. (2009) and Li, B., Akintoye, A., Edwards, P. J., and Hardcastle, C. (2005) which used case studies to tabulate risk.

## 1.7. SOURCES AND RESOURCES

The resources for this report will be obtained from a variety of sources. These include books by Cartlidge and Bult-Spiering & Dewulf, Journal articles from Journal of Construction Procurement, Journal of Construction Engineering and Management, The Australasian Journal of Construction Economics and Building, and various other international sources. New Zealand and Australian treasury and Government briefing papers will be used to gain an insight into the direction that departments will be taking in developing a PSC.

As noted above, the author's employer was engaged by a Government department to consult on a potential Public Private Partnership. It has been deemed inappropriate for discussions with contractors or industry professionals therefore this research will be based purely on published literature.

# 2. LITERATURE REVIEW

## 2.1. Introduction

The term Public Private Partnership (PPP) is a generic term that covers a number of similar contractual relationships between the Public and Private Sectors. There is a multitude of information on PPP procurements, which focuses on individual portions of a PPP. The following literature review will define typical terms used and discuss such terms as Risk and Value for Money, so that a methodology can be formulated to answer the question 'How does the evaluation of risk influence the project value of a Public Private Partnership'.

It has been proposed by academics such as Chan, Lam, Chan, Cheung and Ke in their 2009 paper on Driver's for PPP's, that the Private Sector is better equipped than the Public Sector at 'asset procurement and services delivery'. Grimsey and Lewis described in their 2005 paper that 'PPP's fill a space between traditionally procured Government projects and full privatisation'.

It has been identified by researchers including Lonergan (2006) and Jefferies and McGeorge (2008) that 'Value for Money' is the most important factor in determining the procurement of a PPP contract. However risk allocation is seen by many sources such as Chan et al., (2009), Jin (2009), Li, Edwards and Hardcastle (2005), Kumaraswamy, Ling, Khalfan and Dulaimi (2007) and the New Zealand Auditor-General as the primary objective in PPP procurement

International research has tended to be focused from a Public or Governmental perspective where the emphasis is on Value for Money. Literature from the Private perspective notes different advantages and disadvantages that tend to be based around risk allocation and mitigation.

The United Kingdom appears to have lead the way in the procurement of PPP's and have a preserved 'Father' figure, however Grimsey et al., (2005) have proposed that France was the founding country as they have a long involvement in PPP type procurement dating back to the 17th Century.

The main body of literature the author has focused on comes from the UK, Europe, Australia and New Zealand, however Eaton et al., (2007) also notes Canada, Denmark, Greece, Japan, Portugal and South Africa are utilising PPP procurement, whereas Grimsey et al., (2005) notes that 29 countries procure projects with some form of PPP.

The basis of this research attempts to focus on Social Infrastructure, with special emphasis on the development of new schools. This report has taken resources from a large number of sources to define the meanings of PPP's, demonstrate their characteristics and attempt to value the risks that are commonly included in them.

## 2.2. Defining Public Private Partnerships

Public Private Partnerships (PPP's) have been expressed in different terms, often depending on the country of origin, but intrinsically they all have the same meaning. The United Kingdom uses the term Private Finance Initiative (PFI), Australia has adopted the phrase Privately Funded Project (PFP), whereas the European Union, Asia, North America and New Zealand simply refer to it as a Public Private Partnership (PPP).

In basic terms, a PPP has been expressed as using Private Sector resources to assist Public infrastructure over a time period, usually 25-30 years, Jefferies and McGeorge (2008). Jin (2009, page 19) adds that it involves a "relatively risk-free long term service" and Connolly and Wall (2009, page 3) have noted

that a PPP is “inappropriate without substantial risk transferred to the public sector”. Eaton, Casensky, Peterka and Akbiyikli (2007) adds references from his (and his colleagues) research that the Private Sector ‘determines how’ the services are delivered and Li et al., (2005) describe a ‘wide variety of net benefits’ for Public and Private Sector participants. Grimsey et al., (2005, page 346) includes statements such as “delivery of services to specified levels” to explain the background to PPP’s.

It is the author’s opinion that the Standard and Poor’s definition encompasses a range of ideals that, “A PPP is any medium-to-long term relationship between the Public and Private Sectors, involving the sharing of risks and rewards of multisector skills, expertise and finance to deliver desired policy outcomes”.

For the purpose of this research report it is intended that unless clearly noted that there is a specific description of a procurement model, the term PPP will be used to describe this overall procurement method.

## 2.3. United Kingdom PPP Context and Definitions

In the United Kingdom, the National Audit Office (NAO) has been the main body reporting on the progress of PPP’s. They have defined a PPP as “a contractual relationship between bodies from the Public and Private Sectors with dedicated structures to manage the relationship” (NAO, page 69). HM Treasury notes a similar definition but adds that the relationship is “…for mutual benefit”. Grouped under the PPP banner are such models as Private Finance Initiatives (PFI), Joint Ventures (JV), Strategic Infrastructure Partnerships (SIP), Local Asset Backed Vehicles, Concession and Integrator. The favoured form is the PFI (Cartlidge, 2006).

Following the relaxation of the 'Ryrie Rules' in 1989 (Grimsey et al., 2005) the Conservative British Government launched the PFI scheme in 1992 to aid infrastructure development at both a National and Local level (NAO and Grimsey et al 2005). The Labour Government adopted the principle of PFI in 1997 following the commissioning of the Sir Malcolm Bates report (Kumaraswamy, Ling, Khalfan and Dulaimi, 2007) (Lonergan 2004) (Bult-Spiering, Dewulf 2006). This report defined a PFI as a fixed price contract where by a private consortium is procured following a competitive tender to deliver and maintain a specialised project on a long term basis. Lonergan (2004) and Connelly et al., (2009) amongst others, note that this is usually between 25 and 30 years. In 2000, Grimsey et al., noted that 'Partnership UK' was established to promote the PPP concept.

The preference of the Labour Government to use PPP's for the development and modernisation of public assets was noted by Poole and Mooney (2006) and reiterated by other such as Li et al., (2005) and more recently by the NAO (2009). Most other researchers, especially Lonergan (2009) and NAO (2009) noted that from experience the minimum value is £20 million.

Li et al., proposed in their 2005 journal article, that the response by the industry to PPP/PFI's was 'mixed', however it is the authors opinion that while the article describes important factors in terms of the 'attractiveness' of PPP procurement, this comment is now somewhat outdated.

The Building Schools for the Future (BSF) programme was a 2004 Government initiative in intended to improve both PFI and non PFI school procurement. In 2009 a report by Maltby, N. for the European Public Private Partnership Law Review (EPPPL) noted that, in terms of school projects, eight projects had debt finance closed, four were in the tender stage and 12 were up for tender. The value of these works was not noted but the total debt finance projects closed was in the order of £3 billion.

The determination of ‘how’ the services are to be provided has been expressed by Eaton et al., in their 2007 journal article on UK school procurement as the responsibility of the Private Sector, and the Public Sector defining ‘what’ services would be required. This research has also been sited by Kumaraswamy et al., (2007).

Growing evidence of the popularity of PPP’s was identified by the NAO that as of September 2009 the number of PFI’s in England has exceeded 500 and was valued at over £28 billion.

## 2.4. Australian PPP Context and Definitions

In defining the context of PPP’s in Australia, the Government structure must be noted because the various State Governments refer to the term in different ways. Simply, Australia is governed by a Federal System that incorporates a Commonwealth Government and Six individual State Governments. This report will focus upon the Victorian and New South Wales approaches to PPP’s as the literature observed and especially Grimsey et al., (2005) describe the Victorian market as being dominant, followed by NSW.

The State of Victoria was the first state to implement PPP procurement and instigated ‘Partnerships Victoria’ to provide Government agencies with a guideline for PPP procurement. The document notes that the term PPP is refined to Privately Financed Project (PFP), however Jefferies and McGeorge (2008) note that the dominate model is a Private Finance Initiative (PFI). It is this author’s view that there is only a slight difference in the two terms and PFP is the most relevant.

NSW has taken Victoria’s PFP approach and developed it to conform to its own state regulations. The NSW Auditor-General defines a PFI as involving

"the creation of an asset through private sector financing and ownership control for a concession period" (2006, page 12). Typically they note that projects exceeding $50 million are viable for PFP procurement. The NSW Department of Education and Training (DET) have noted that they operate in excess of 2400 schools and have assets value at $15 billion.

In 2008 Infrastructure Australia, a Government organisation, published the National Public Private Partnership Guidelines. This six volume publication has taken the Victorian Partnership and New South Wales Working With Government Guidelines publications and developed an extensive guideline for PPP procurement.

It is the author's intention to use the Victoria Partnership and National Public Private Partnership Guidelines to develop the spreadsheets included in this report.

## 2.5. New Zealand PPP Context and Definitions

The New Zealand construction industries contribution to the countries GDP has been documented by the NZ Treasury and Miller (2008) as being in excess of 5%, with the value of its spend on capital assets in the order of $3 billion per year. The industry has traditionally procured contracts, as defined by the Department of Building and Housing (DBH) in their 2008 scoping paper on the procurement of projects, as either Linear, Design and Build, and Management basis. The DBH also explains that Alliances, Partnering or Joint Venture approaches are increasing to a small degree. Their paper makes no specific mention of PPP but the context of the literature outlines characteristics of them.

The previous Labour Government, under the direction of the then Minister of Finance, the Hon Dr Michael Cullen, was investigating the possibility of

procuring large capital projects on a PPP basis. The DBH noted that Treasury is experiencing ‘cost overruns’ and producing ‘lower then expected benefits’ over the last decade. As part of the Capital Management Programme, Government agencies were expected to improve ‘quality at entry’, which is simply the realisation that the Whole Life Cycle Costs are as important as the initial capital cost. In short, Treasury was attempting to determine the costs, risks and benefits of capital expenditure and potentially propose, by the reference to risks, the introduction of PPP’s.

Following Labours’ ousting in the 2008 General Election the Treasury issued a briefing paper to the incoming National Party Minister of Finance on Economic and Fiscal Strategy and commented that “PPPs can produce benefits over and above conventional procurement in some areas where details are right” (page 18). These benefits included:

- Whole Life Cycle Cost minimisations
- Greater cost certainty
- Financing cost optimisation
- Improved maintenance of school facilities
- Greater community use of facilities

The briefing paper explains further, that there is limited capacity in Government to develop the skills and quality assurance necessary to implement this type of contract. The National Government has since appeared to move rapidly in investigating the PPP method of procurement.

The National Infrastructure Unit of the Treasury released a guideline in October 2009 for PPP’s in New Zealand. They defined a PPP as a “long term contract(s) for the delivery of a service, where the provision of the service requires the construction of a facility or asset, or the enhancement of an existing facility” (page 1). They add that the Private Sector would finance the

project and transfer control to the Public Sector upon completion of the contract.

The New Zealand Council for Infrastructure Development (NZCID) have produced a number of publications on PPP's and offer this definition which appears to condense the meaning of a PPP into a "service contract between the Public and Private Sector where the Government pays the Private Sector to deliver infrastructure and related services over the long term". Unfortunately this does not fully encapsulate the finite terms of a PPP, as there is no specific mention of financing.

From the author's perspective, the ministerial use of the term PPP is liberal since a major portion of international PPP's reflect on the need to include operation of the asset.

The New Zealand construction industry is very small in comparison to the United Kingdom or Australian markets as generally described in this report. The New Zealand Auditor General has expressed that "projects here may not be larger enough to attract significant interest" (page 7, 2006 Audit Report). Treasury has noted that a budget of more than $50m is suitable for the procurement of a PPP however, the author is aware that various Government departments have a mandate that any projects over $25m should be assessed as a PPP.

At present with the number of projects earmarked for PPP procurement this is a potential issue, however if the larger organisations are not interested then the second tier operators may want involvement. To date there has not been a signed PPP contract in New Zealand, although there have been a variety of partnering contracts based loosely around the PPP notion. Notable projects are:

- Auckland Indoor Arena (Vector Arena) – Design, Build, Finance, Maintain and Own

- Auckland Grafton Gully – A project alliance to design and build
- Wellington Clear Water Treatment Plant – Design, Build, Maintain and Operate
- Canterbury Landfill – Public Private Joint Venture, construction through an alliance
- Waterview Connection – PPP Public submission and business case
- Wiri Prison – Currently in the PPP Business Case stage

The Minister of Education, the Hon Ann Tolley, expressed on the Government's website in December 2009, that in terms of a PPP for schools the "Private Sector would have responsibilities in relation to school property for the life of the contract but the operation of the school would remain the responsibility of the Board of Trustees". The consortium would therefore own the buildings and technically be able to use it for its own uses outside of school hours. Collin Espiner, a reporter for The Press (Christchurch) posted comments on the 12th March 2010, that in a cabinet report on PPP's, one of three upcoming new schools is earmarked to be a PPP based contract.

In August 2010, the Ministry of Education advertised for consultant and advisor positions to prepare the second round business case for the proposed new school in the North Island. From the Ministries 'Expression of Interest' the author is aware the business case is to be finalised by mid 2011, however the location has not been made public.

It appears that the National Government is taking a safe approach to PPP procurement for schools. As discussed previously in this report, the current method for new school development is the Single Line accountability model, which relies on a Guaranteed Maximum Price contract. The form of PPP that the government is proposing would only add value by shifting the risk of the construction financing and long term maintenance to the consortium. The lack of inclusion in the operation of the school is clearly seen as a risk by the Government as the New Zealand Educational Institute has opposed the use of

PPP's (Espiner, 2010) as there is the perceived risk of teacher backlash. This is a logical point of view and is backed up internationally by Kumaraswamy et al., (2007).

## 2.6. Characteristics of a Public Private Partnership

Internationally, Public Private Partnerships generally follow a similar definition and have the same characteristics even though they are called different things (Kumaraswamy et al., 2007). The following section will discuss the characteristics or underlying features of a PPP from a global perspective with examples from specific countries and projects.

From the sources and definitions noted previously, a typically PPP would exhibit the following characteristics:

- Procurement and Contract Negotiations
- Development of the Contract Specification
- Consideration of the Value for Money and Assessment
- Financial Optimisation and the Cost of Finance
- Risk Assessment and Risk Allocation/Transfer
- Whole Life Cost Assessment and Maintenance

It has been identified by the author that this research will be focusing on benefits and risks for PPP procurement. It is intended that this section forms a brief overview of the characteristics of PPP's with reference to current literature.

The sections on Value for Money, Risk Assessment and Risk Transfer will go into more detail as the literature discussed will provide the basis of this report.

## 2.7. Procurement and Contract Negotiations

The procurement of PPP contracts follows similar steps as standard procurement. Researchers such as Chan et al., (2009), Li et al., (2005), Jefferies et al., (2008) and Cartlidge et al., (2006 have identified a number of similar steps which can be listed as:

- A Government would identify the need to develop infrastructure.
- A scope/specification would be created for the project outlined the required deliverables.
- A process of Registrations of Interests (ROI) would be advertised and short list prepared.
- The chosen Tenderers (between 2 and 4) would prepare their tender.
- The Public sector would evaluate the tenders.
- Contract negotiations and refinement of the scope/specification would continue until the contract was signed.
- The successful consortium would design, finance, maintain and operate the asset for a fixed duration.
- The Government would pay the consortium an annual fee for the duration of the contract, which depending upon the contract could be for up to a number of years or a few decades.

The Procurement and negotiation phase is seen by many as critical for the "optimal mix of price, quality and risk transfer" (NAO, 2007, page 12). However, they also note that private finance tendering is normally a lengthy and costly process. On lengthy deals, Davies and Eustice (2005) have noted examples where bid cost equalled 3% to 4% of the value of the project. The NAO notes that the costs for large or complex bids would also deter some bidders.

Kumaraswamy et al., (2007) have described that the number of bidders prepared to submit detailed bids is generally low due to the lengthy tender period. Likewise, the NAO also explains that number of bidders can effect the negotiations as if only two bidders are sought at an early stage it potentially leaves the project vulnerable if one of the two bidders pulled out. In the NAO's 2007 report into procurement of PFI projects, they noted that the Private Sector was 'selective in developing detailed bids'. The UK Treasury has noted that lengthy periods can inflate cost associated at the beginning of the contract.

It has been outlined by the NAO that on average it took 34 months to undertake the tendering and negotiation process, however the European Public Private Partnership Law Review (EPPPL) reported that the average time was 24 months. Davies et al., (2005) sighted this review but noted that there were cases that lasted three to five years.

## 2.8. Development of the Contract Specification

In determining what the necessary outcomes for a project are, the Public Sector will develop a specification or scope that the consortium will tender for. Often this can lead to the consortium providing a project that has a higher standard than would potentially come from the Private Sector. The Contract Specification or Output Specification, as noted by Partnership Victoria is also an intrinsic part the Public Sector Comparator, which will be discussed in subsequent sections of this report.

It has been noted by the NAO (2009) that the process of tendering for a PFI can derail innovation because the time to tender does not allow for in-depth design. The end user often has a variety of consortia to assess and often there is insufficient time to decide what designs will work.

As is often the case with construction projects and procurement, the initial concept design seldom resembles the finished product. With PPP's the tender process will include a design based on the Public scope, however there can often be a de-scoping of the project to make it affordable (Cartlidge et al., 2006).

In developing a full Business Case for a PPP, the Output Specification of the project is the one item that has the most influence on the potential outcomes. The Output Specification is the level of information/scope which the Government will supply to the Consortia. The New Zealand Government has determined three specification options, Minimum, Medium and Full Specification.

The Minimum Specification is commonly a series of minimum requirements, the author's example is, the project must "Provide sufficient facilities to support the current educational requirements". Likewise a Full Specification will predominately supply the consortia with fully detailed specifications of the requirements of the project, for example, "Provide fourteen teaching spaces of 78m² that include Miller desks and IBM computers for a ratio of 1:1".

This Output Specification is critical as there are Advantages and Disadvantages for either option and the risk transfer varies. The Ministry of Education's use of the Single Line Accountability Design and Build model steers itself to a Minimum Output Specification. The tender documentation that the consortia tender off is usually only a few pages long and consists of the Area requirements and cost per m² to give an overall budget.

For the purposes of this report a Minimum Output Specification will be assumed.

## 2.9. Consideration of the Value for Money and Assessment

If there is to be one defining idiosyncrasy of a PPP it must be whether it is Value for Money (VFM). Literature from all sources obtained makes mention of VFM in some form or another and this report focuses on VFM and how it is associated to risk. The recent Ministry of Education tender for technical advisors (as noted in section 2.5 of this report) sighted that under a PPP a contract saving of 2.6% over convention procurements could be expected.

Jin (2009) notes that risk transfer is a driver for VFM, where as the New Zealand Auditor-General and the NAO simply identify that VFM is a measurement of whether a project would be better off if it has been procured entirely by the Government. Connelly et al., (2009) say that VFM assumes "that competitive tendering and superior private sector efficiencies produce economies that off set the higher cost of borrowing" (page 5).

Lonergan (2004) noted that debate has grown on the issue of VFM and in sighting a 2003 UK House of Commons paper they asked how it was possible to "demonstrate that something is additional to what would have happened any way". Grimsey et al (2005), Lamb et al., (2004), Khandaroo (2008) and Morallos et al., (2008) have all written papers focusing on VFM, however these are just a few of the countless authors that have provided opinion and research on the topic.

The worthy definition of VFM comes from research undertaken by Grimsey et al., (2005) who have been sighted by Chan et al., (2009, page 1116) as "the optimal combination of whole life cycle costs, risk, completion time, and quality in order to meet public requirements". Grimsey et al., (2005, page 347) also adds that it should include "the use of an output specification; competition; performance management and incentives; private sector management skills".

The NAO defined that for a project to achieve VFM it needed to demonstrate that the additional risks of a PPP could be justified by quality improvements, efficiency savings and better management. It noted that it was difficult to comment on the VFM a PPP has, rather it was important to examine the failures. It is noted by the NAO that the "ultimate responsibility for delivery always remains with the Public Sector" (page 24).

The Value for Money is often reliant upon the number of bidders, as the NAO explained in their 2007 report on PFI procurement, when only two bidders are tendering it removes "a second opinion" that would occur if a third bidder was present. VFM is at the most risk at the end of contract negotiations where the competitive tension is the lowest due to the inclusion of a single preferred bidder (NAO). Connelly et al., (2009) also reflect that competitive tension is very important for VFM.

The New Zealand Auditor General has expressed that factors in assessing Value for Money include:

- The scale of the project relative to the transaction cost
- The Whole of Life Costs
- The potential to free up Public Sector staff
- Greater asset utilisation
- The scope for innovation

The New Zealand Council for Infrastructure Development (NZCID) have outlined on their website that the "best Value for Money is normally achieved on major and complex projects, where there is opportunity for innovation and risk sharing". It appears that the NZCID have used the lead of the NSW Government as they refer to the use of Public Sector Comparator (PSC) to assess value for money on PPP projects. Due to the limited number of PPP's in operation in New Zealand it appears to the author that this is a simplistic approach. It is acknowledged that the New Zealand Government does not have

surplus funds available to invest in massive projects that the NZCID would be focusing on.

It is the author's opinion that the information provided by the NZCID is slightly biased because it is focused on the positive side of PPP's and makes few mentions of any potential negative effects or risks.

As an example, the proposed Waterview connection was earmarked by the Government as a PPP in December 2007 (King, 2008). This $1.89 billion project intends to link State Highway 16 and State Highway 20 by constructing a Ring Route tunnel through Mt Roskill. The Steering Committee, formed in 2008 and chaired by Sir Brian Elwood, reported on the 26th June 2008 that there were a number of conditions that had to be met if a PPP was to offer Value for Money. These included:

- Project size
- Public Sector Commitment
- Opportunities for risk transfer
- Clear Project Objectives
- Adequate Resources and Defined Roles
- Ensuring Competitive Tension
- Network Optimisation

The report noted that the most significant driver for VFM is "Private Sector finance because it creates incentives for innovation and cost savings" (page 24). They list a number of criteria for assessing VFM, which include:

- Reduced Whole Life Costs
- Greater user benefits
- Additional revenue sources
- Better Public cost estimation
- Community Benefits

- Low tendering and contracting costs
- Low contract charges
- Easy contract enforcement

In simple terms, VFM is seen by the author as only as good as what you compare it against and the initial assessment criteria that facilitates the comparison.

Research and literature from most sources the author has sighted in this report and especially the Victorian Government, Pricewaterhouse Coopers, Grimsey et al., (2005), Lamb et al., (2004) and Jefferies et al., (2008) has expressed that a Public Sector Comparator (PSC) is a common benchmarking tool in defining PPP VFM. Chan et al., (2009) and Morallos et al., (2008) concurs with this comment and adds that it identifies the cost for the Private Sector to provide an asset compared to the Government providing it.

Partnership Victoria (2001 page 14) has described a PSC as a calculated value of the "Net Present Cost (NPC) of the expected Whole of Life Cost to the Government of the Reference Project". This NPC will be explored in later Chapters of this report.

Grimsey et al., (2005) explains that the PSC has two distinct purposes, namely to provide a benchmark based on a hypothetical model and to compare the benchmark against the actual cost submitted by a consortium. Basically a PSC is developed during the development of a Business Case and prior to any involvement from consortia, to form a reference point for costs and revenue. Grimsey et al., (2005) notes that this is undertaken so that it "is a 'pure' Public Sector opinion, not influenced or potentially influenced by ideas coming forward from PPP bidders".

The New Zealand Treasury has defined the PSC in their 2009 guidelines for PPP procurement (page 14) as "a measure of what the project would cost if

delivered through conventional procurement". They note that it is made up of the following:

- "The construction and operating costs"
- "Competitive neutrality adjustments to remove any advantages or disadvantages that accrue to a public sector procurer by virtue of its public ownership."
- "Provision for any additional costs and risks that would be transferred to the private sector partner under a PPP".

Partnerships Victoria (2001) noted that "the PSC is constructed and refined during the initial assessment and pre-market stages of a project prior to release of the Project Brief" (page 4). Like the New Zealand Treasury they identify the roles that the PSC performs, which are highlighted as:

- Promoting early comprehensive cost planning
- A key management tool and assists Government departments to manage the process and determine the specification, risks allocation
- Demonstrates Value for Money
- Provides a benchmark
- Provides confidence in the procurement procedure and potentially completion between bidders.

As outline in the Victorian document a PSC is made up of the following calculation:

**Transferable risk + Competitive Neutrality + Raw PSC + Retained Risk**

**Transferable Risk:**

As noted further within this report, risk and the allocation of which party assumes that risk is the key objective of a PPP. The cost associated with

risk and the ‘cost’ that risk has, if transferred to a consortium, and how it will affect the VFM a project has. Transferred risk is deducted from the PPP cost within the PSC assessment. Grimsey et al., (2005) has noted that as a percentage of the total PSC it can be between 10 and 15 percent.

**Competitive Neutrality:**

Predominately the adjustment for competitive neutrality consists removing any advantage the Government has. Grimsey et al., (2005, page 357) has identified “land, Local Government, payroll and capital transaction taxes”, Partnership Victoria (2001, page 25) includes “public scrutiny and reporting requirements faced by a private enterprise”. In simple terms, if competitive neutrality is not undertaken, the PSC may be artificially lower then a potential consortium bid.

It has been identified by the author that this section of the PSC could have little effect on the PSC because a school does not pay local Government rates, development contributions or the like. It is assumed that this would also be the case if a private consortium was to operate the school. This will be discussed further in Chapter Four of this report.

**Raw PSC:**

The raw PSC is the capital and operating cost of the project. It is a calculated sum of the construction cost, life cycle costs and operating costs based upon the contract specification for a hypothetical project. The raw PSC is purely an assessment of the assumed cost to build now and projected running cost over time and does not include any assessment of risk.

**Retained Risk:**

This is simply any risk that is not transferred to the consortium. These are outline further in this section of the report.

Also included in the PSC is a discounted cashflow calculation, which incorporates the above and a discount rate. The discount rate is a calculated rate in which the government estimates the "time value of money plus systematic risk value" Victoria Partnership (2001, page 19). Morallos et al (2008) has sighted various authors (such as Grimsey) that based on projections and 'crystal ball' assessments, the risk of the discount rate should be excluded from the PSC and retained by the Public Sector.

The author's personal experience is that the discount rate has a huge impact on the PSC and is complex enough to warrant its own specific research, as has been undertaken by scores of academics. It has been decided that because this report is going to focus on assessing risks associated with the construction and operations of a hypothetical school, the assessment of the discount rate would be excluded.

For the purpose of this report (and discussed in Chapter Four) the current New Zealand Treasury discount rate of 6% will be used. This information was obtained from the NZ Government website (http://www.treasurary.govt.nz /publications /guidelines/reports/accounting/discountrates/index.htm).

Authors such as Morallos et al., (2008), Partnership Victoria (2001) and Cartlidge (2006), to name a few have defined this relationship of VFM by way of Figure 1 on the following page.

This figure demonstrates each of the sections of the PSC and the PPP Consortium Bid. The PSC is the calculation of the Net Present Cost of the Public Sectors hypothetical project based upon the Output Specification. This will be discussed in detail in Chapter Four of this report.

The PPP Consortium Bid is the total of the intended Service Payments that the Private Sector requires and the Retained Risks of the Public Sector. This Service Payment is the Consortiums tender price to build, operate and maintain

the project, inclusive of funding and profit. The Service Payment is generally paid to the Consortium in regular yearly payments over the life of the contract once the asset is operational. It is noted by Ng, S. Xie, J. and Kumaraswamy, M. (2010) that there is a "long period of cash outflow before a net cashflow can be realised" (page 355).

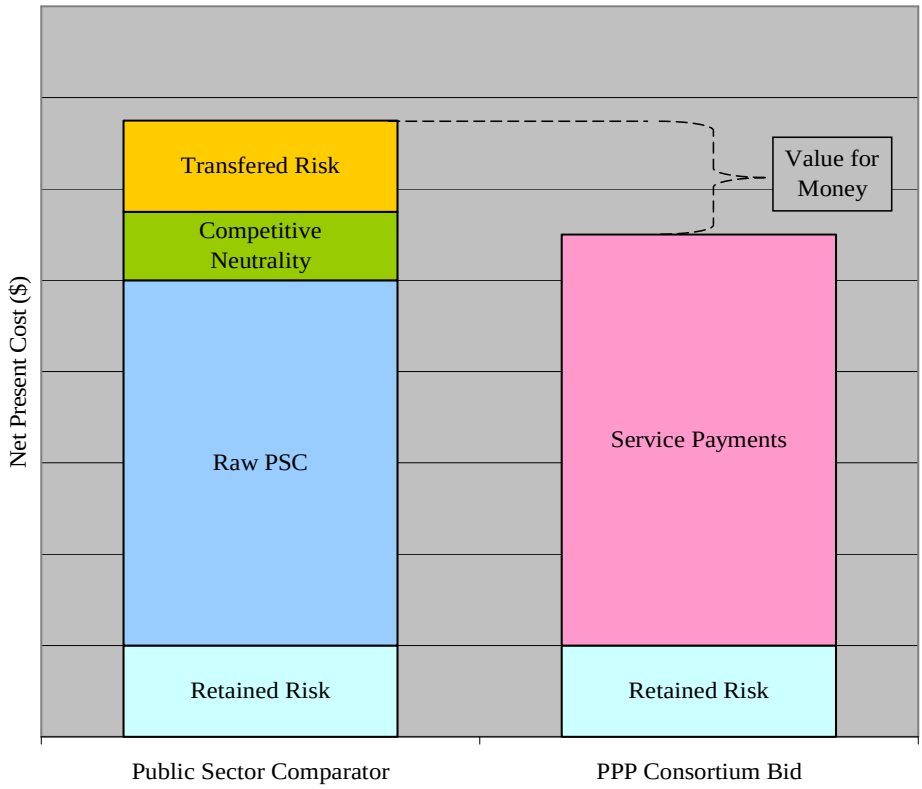



**Figure 1:** Value for Money as Demonstrated by PSC Evaluation (Morallos et al., 2008)

If the sum of the PSC is greater than the cost submitted by a consortium (Service Payments and the Retained Risk by the Public Sector) then the PPP will be VFM.

The approach of using a PSC to determine VFM is in no way universal. Many countries do not use a PSC. The Unites States predominately excludes a PSC type assessment. Grimsey et al., (2005) has used the example that some States expect that the cost benefit through the process of tendering a PPP project is approximately 5-10% lower than the cost it would be if it was run by the State.

The author assumes that this is based upon running and fixed/typical maintenance costs and is based upon historical information. France, Latin America and most Eastern European countries also do not use a PSC but rely on a concession model purely because the type of procurement has been in place for such a long period of time.

Lonergan (2004) notes that the PSC focuses on narrow benefits, often at a stage in procurement when the scope has not been clearly defined. The information resulting from a PSC is dependant upon the long-term forecast and Jin (2009) continues that it can be highly sensitive to risk allocation. Jefferies et al., (2008) notes that it can be inaccurate because it is only an approximation and not based on current costs. They also explain that the assessment is beneficial in terms of decision making and accountability, but is often arbitrary and subjective. Grimsey et al., (2005 page 358) also notes that it can be "manipulated to show what ever the users require it to show", and the author tends to agree based on experience in developing a PSC for this report

The New South Wales Auditor General has commented that the "comparator analysis should not be seen as only a means of supporting decisions on whether to proceed or not to proceed with PPP's, rather they could be used to drive better value from private sector bids, by focusing on individual elements of bids that could be improved" (page 31).

This report is attempting to create a hypothetical PSC for a hypothetical school to value risk and determine how changes in risk assessment can affect not only Value for Money but also and more importantly the validity that a project should be procured by way of a PPP.

The author's observations while being involved in technical assistance in a real life Public Private Partnership contract has been backed up by the abovementioned research, which notes that subtle changes in the PSC can have

a dramatic effect on the viability of a project, thus there must be accuracy of assessing and forecasting sections of a PSC.

## 2.10. Financial Optimisation and the Cost of Finance

A PPP provides Governments with the ability to develop infrastructure without constraining their budget, Jefferies et al., (2008) and improves cashflow management, Chan et al., (2009). It has been observed by Kumaraswamy, Ling, Khalfan and Dulaimi in their 2007 paper that "if it can be shown that economic costs associated with implementing a project in partnership with the Private Sector are much lower than if it is developed by the Public Sector" (page 123), then a PPP is recommended.

It has been widely publicised, for example NAO (2009) and Lonergan (2004), that the private finance comes at a premium than if a Government was to fund a project from its own borrowing. Government borrowing is funded from tax revenues and is therefore seen as low risk. Most references make mention that procurement under a PPP represents a reduction in public debt.

Quiggin notes that it is a "way of funding infrastructure without incurring debt" (Quiggin, 2004 page 59). Lonergan (2004, page 9) adds that it is "at a lower funding premium". Both sources do however note that even though Public Sector borrowing is seen as risk free, there is a residual risk to the taxpayer.

Reports of a 1% to 1½ % premium have been proposed by the aforementioned authors where as Davis et al., (2005) and Spackman (2002) determined it between 1% and 3%. It is poignant to note that the NAO has estimated that post 2009 Credit Crisis the banking sector finance rates have risen by approximately 2.5 %.

The financial content of a PPP clearly lies with the Private Sector and financial institutions who assess the financial risk as the highest priority. Jefferies et al., (2008).

In the UK, one huge advantage is that due to accounting principles, a PPP does not appear on a Government's balance sheet as public borrowing (NAO, 2009) , (Lonergan, 2004) therefore the Government's 'books' could look better than the actually are.

## 2.11. Risk Assessment and Risk Allocation/Transfer

Risk allocation is seen by many sources such as Chan et al. (2009), Jin (2009), Jefferies et al., (2008), Li et al., (2005), Kumaraswamy et al., (2007) and the New Zealand Auditor-General as the primary objective in PPP procurement and project success. It is simplistic to assume that the more the risks transferred to the Private Sector by the Public Sector the better.

The level of risk is often determined by the particular project. Jefferies et al., (2008) notes the risk of operating costs of a hospital or school could be higher than a road, therefore it could be better to retain some risk by the Public Sector rather than pass it to the Private Sector who could value it at a premium, thus raising the value of the Service Payments.

The National Public Private Partnership guidelines explain that;

> "Optimal risk allocation seeks to minimise both project costs and the risks to the project by allocating particular risks to the party in the best position to control them. This is based on the theory that the party in the greatest position of control with respect to a particular risk has the best opportunity to reduce the likelihood of

> the risk eventuating and to control the consequences of the risk if it materialises" (page 29).

Bing et al., (International Journal of Project Management, 2005 page 26) has provided a simple explanation of the process of risk assessment as: "the public sector identifies the risk attached to the project in a risk register, setting out the risks relevant to each stage of the project, the likelihood of occurrence for each risk event and an estimate for the financial consequences".

A Government must identify which risks it should retain because in some cases the Private Sector is not set up for dealing with them, and would potentially pass on a higher cost to cover them than it would cost the Government (Connolly et al., 2009). Governments must retain some risks and Davies et al., (2005 page 28) propose that PPP's are "designed so that the risks are allocated to the party which is best able to manage them", Partnerships Victoria (2001, page 50) adds that this depends on the ability "to manage the risk at the least cost". This is also noted by Cartlidge (2006).

Jin (2009) outlines that in theory, the Government should be transferring all the risks to the Private Sector, however there are some risk that it should accept for 'optimal risk distribution'.

Bing et al., (International Journal of Project Management, 2005) has also identified that there are three categories of risk, namely Macro Risk that reflect Government based risks such as interest rates and public opposition, Meso Risks with examples such as construction delays and building, and Micro Risks, for example a consortium's inexperience or staffing issues.

It has been discussed by Davies et al., (2005 page 28) that "PPP's do not achieve absolute risk transfer". This is seen by the author as a logical approach as it would be difficult to foresee all of the future risks of a project and then allocate them to the benefit of each party.

The NSW Department of Education and Training (DET) outlined a ‘plan’ to transfer risks to the private sector. These included design, construction, facility operation, maintenance, inflation linked payments, changes in interest rates.

These were seen by the NSW Auditor General as good examples of risk transfer and potentially VFM. The study however does not sight all of the Public risks apart from the risk that the role may alter. This has been discussed later in this report under the New Zealand Project Context as it has consequences for the Public Sector.

The NZ Treasury in their 2009 guidelines for PPP’s defines a number of key factors in the allocation of risks which appear to expand upon Lonergan’s research. These are identified as:

- Financial and commercial members developing the risk matrix
- Legal advisers to determine the intent of the risk allocation
- Determining the likelihood of the risk occurring and how to manage it if it does
- Identify who is best suited to manage the Resource consent process

Literature proposes a variety of Public and Private Sector risks. It has been determined by the author that to display the literature in simple terms a tabular display will show how risks are identified by different researchers.

Table 1 on the following page is a condensed version of Appendix Two, which is a full list of all the risks discovered from the corresponding researchers.

**Table 1:** Literature Referring To Public and Private Sector Risk

| | | REFERENCE LITERATURE | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bing, L et al. (2005) | Brady, K.B, (2006). | Cartridge et al. (2006) | Grimsey, D. et al. (2005) | Infranews (2006) | Jefferies, M et al. (2008) | Jin, X.H. (2009) | Jin, X.H et al. (2008) | Khadaroo, I. (2008) | Lonergan, R. (2004) | Marques, A. et al. (2009) | National Audit Office. (2009) | NSW Auditor General. (2006) | Ng, A. et al. (2007) | Partnerships Victoria (2001) | Quiggin, J. (2004) | Waterview Steering Committee (2008) |
| RISKS | Construction Risks | x | x | x | x | | x | x | | x | | x | | x | x | x | x | x |
| | Demand for the Asset | x | x | x | | x | | | | | x | | | | | x | x | x |
| | Design Risks | | x | x | | x | x | | | | | | | x | | x | x | x |
| | Environmental | x | | | | | x | | | | | | | | x | x | | |
| | Employees | | | | | x | | | | | | | x | | | x | | |
| | Financing | x | x | | | | x | x | | | | x | x | | x | x | | |
| | Force majeure | x | | | | x | | | | x | x | x | | | | x | | x |
| | Interest rate volatility | x | | | | | | | | | | | | x | | | | |
| | Inflation | x | | | | | | | | | x | x | | | | | | |
| | Market Risks | x | | | | | x | | | | x | | | | | | | x |
| | Maintenance costs | x | x | | | | x | | | | x | x | | | | | | |
| | Operating the Asset | x | | x | | | x | | | x | | x | | x | | x | x | x |
| | Policy/Regulatory Changes | x | x | | | | | | | x | x | | | | | x | x | x |
| | Political opposition | x | | | | | x | | | | | x | | | | | | |
| | Poor public decision making | x | | | | | | | x | | | | | | | | | |
| | Public opposition to project | | | | | | | | x | | | x | | | | | | |
| | Revenue from the Asset | | x | x | | | x | | | | x | | | x | x | | | |
| | Technology and Obsolesce | | x | | | | x | | | | | x | | | | x | | |
| | Termination Costs | | | | | | | | | | | | x | | | | | |
| | The Site | x | | | | x | x | | | x | | | | | | | | x |
| | Timeliness | | | | | | | | | x | x | | | | | | | |

Valuing risk is a complex process and one that has been sighted by many researched included in this report. The assessment of the value of risk ranges from simple probability techniques to complex statistical analysis based on techniques such as Monte Carlo analysis. Partnerships Victoria (2001) outlined that the Public Sector Comparator requires an assessment of risk and proposes that risk should be calculated by the following:

**Value of Risk = Consequence x Probability of Occurrence + Contingency**

The above equation is very simple in its form, but the factors could be difficult to determine. The 'consequence' would be apparent and assuming the contract included clear 'punishments' for non performance, this could be measured. The 'probability of the risk occurring' can be gauged by using a statistical analysis.

Victorian Partnerships note that the difficulty in assessing the financial impacts of risks lead to the inclusion of contingencies, while still being conscious of the risk being cost effective. The contingency has been sighted by authors such as Ball et al., (2003) as not being necessary as it is another assumption that needs to be substantiated, The author agrees with this comment and has not included a contingency in the risk register as it is seen as a difficult assumption to clarify.

To determine the impact of a particular risk, this report has used a simple risk matrix outlined by Ball et al., (2003). They note, as shown in Figure 2 on the following page, that a risk is ranked into either a High, Medium or Low impact, for example, a "low probability and high cost gives a medium impact" (page 283). Chapters Three and Four will expand on this idea and the measurement of risk.

| | | | | |
|---|---|---|---|---|
| **Cost** | **High** | Medium | High | High |
| | **Medium** | Low | Medium | High |
| | **Low** | Low | Low | Medium |
| | | **Low** | **Medium** | **High** |
| | | **Occurrence Probability** | | |

**Figure 2:** Risk Matrix, Ball et al., (2003).

For the development of a robust Public Sector Comparator the author's valuation of risk is very important. Various techniques have been described in the literature sourced for this report. For example, Li, B. (2009) has identified valuing risk with statistical analysis and risk modelling and the New Zealand Government references the 'Australian and New Zealand Risk Management Standard NZS4360:2004: Risk Management'. The author has used a mixture of valuation techniques to value risk, which are described further in Chapter Four of this report.

As noted previously, risk should be allocated to the sector that is able to manage it effectively. If too much risk to proportioned to the private sector the public sector may be paying a premium ( NAO, 2009).

Risk allocation should be determined for each project and consideration of the following factors quoted by Partnership Victoria may be included:

- The context of the project
- The strengths of the sector to manage the risk
- Flexibility of the scope/specification
- Historical levels of risk transfer
- Market attitudes
- Public interests

The ability for the Public or Private Sectors to determine the risks of a project is seen by the author as a simple task, however the valuing of these and the corresponding costs placed on a project may be rather more difficult.

## 2.12. Whole Life Cost Assessment and Maintenance

The focus of a Public Private Partnership is that a Consortium need to focus on providing an asset that is more efficient in terms of the life cycle costs because it needs to operate and maintain it rather than just build it and hand to over to it owner to 'deal with'. Predominately this can lead to higher upfront costs if the expectation is that there are lower running costs (Eaton et al., 2007).

From the authors own experience, school buildings and potentially public buildings in general are inherently prone to damage. It has been expressed by Network Facilitators in the Ministry of Education that a new or refurbished school has a 'grace' period of around 6 years where damage is minor. After this time, as the building slightly ages, damage increases.

Ministry of Education guidelines for the Maintenance of buildings set out a list of obligations that the Board of Trustee must comply with. The school is

funded for maintenance by the Ministry of Education under a system called 5YA Funding, which is a predetermined sum based on the area of the school and calculated every five years. It has always been the author's experience that this funding is often inappropriate and schools have often deferred maintenance or spent the funds in other areas. In some cases the Ministry has had to provide further funds to maintain the school.

In the case of hospitals, the life cycle cost can be difficult to determine due to 'technological advances' Jefferies et al., (2008). In the case of schools the technology may not be as inherent as in a hospital but the advance in teaching media over the past few years have seen the inclusion of wireless networks and web based learning, which was not available 10 years ago.

As noted in section 2.9 above, the Public Sector Comparator includes the assessment of life cycle costs, which will be assessed under Chapter Four of this report.

## 2.13. Summary of Literature Review

This literature review has attempted to define Public Private Partnerships in its various forms. It is the author's opinion that the Standard and Poor's definition encompasses a range of ideals where 'A PPP is any medium-to-long term relationship between the public and private sectors, involving the sharing of risks and rewards of multisector skills, expertise and finance to deliver desired policy outcomes'.

Characteristics such as Value for Money, Risk Assessment and Risk Allocation are noted as being intrinsic factors for PPP procurement. Tools such as the Public Sector Comparator are readily used to determine the Value for Money however it can use general assumptions, which if subtlety changed can alter, or

be used to alter, the final output. Based on the authors investigations into the various sources of information on PPP risks it has been concluded that there is sufficient literature to provide a basis for developing a robust report into ‘How does the evaluation of risk influence the procurement of a project under a Public Private Partnership’.

# 3. METHODOLOGY

## 3.1. Background

As indicated under Chapter 1.1 (Background) of this report, the author's employer was engaged by a Government Department as a consultant to advise on Public Private Partnership (PPP) related issues. As part of the engagement the author was required to sign a confidentiality statement, therefore the author considered it inappropriate to discuss any of this research with consortia/construction companies or the Ministry of Education currently involved in the construction of schools.

The author has been involved with analysing data that will potentially be included in a business case for a PPP. Prior to the development of this research the author was not fully versed with the intrinsic nature of the assessments/assumption made. It has been necessary to investigate a number of methodological options to determine the best way of identifying the risks apportioned to PPP's without compromising the terms of the author's confidentiality agreement with his employer. It should be stressed that the information incorporated within this report is in no way derived from commercially sensitive information and has been developed fully from publically accessible literature.

## 3.2. Introduction

To answer the research question, 'How does the evaluation of risk influence the project value of a Public Private Partnership – A case study of risk using a Public Sector Comparator for an education project' and while maintaining the restrictions of the authors employment, it has been decided that a Quantitative 'desktop' analysis of available literature data is the best option.

This research is attempting to assess risk in terms of cost by developing a Public Sector Comparator (PSC) for a hypothetical secondary school. This school will be based on the Ministry of Education's publically published criteria and determining project costs. The aim is to use literature to identify risk, which will be apportioned then inserted into a risk matrix and valued. This value of risk will then be added into a developed PSC that will under go a series of analysis to show the affect that reallocating risk has on the overall cost of the project.

## 3.3. Current School Procurement Methods

In describing the methodology used in this report, it is first necessary to briefly define the basis of the information that will be used to develop the PSC and therefore produce potential results. As outlined in section 1.3 of this report, the Ministry of Education has, for the past few years, undertaken all their new school construction projects on a Single Line Accountability Design and Build model. The model is noted below in Figure 3.

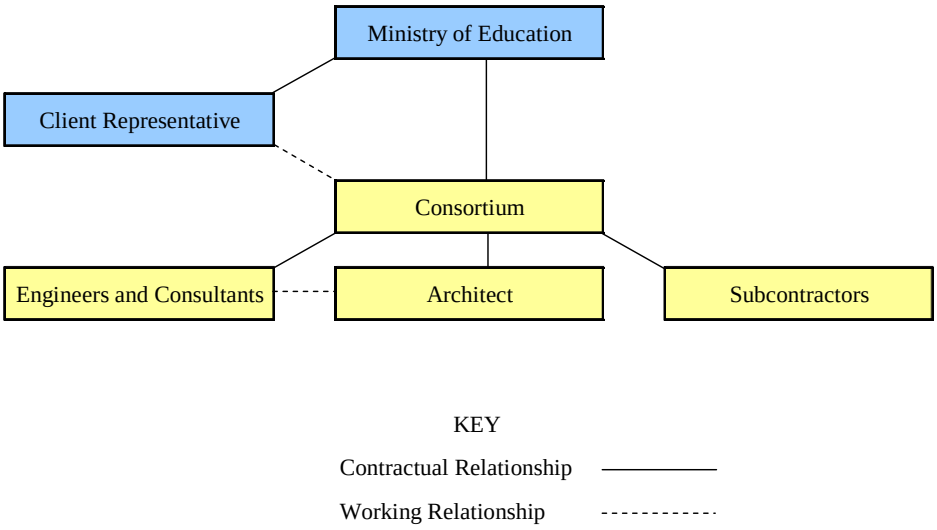



**Figure 3:** Single Line Accountability Design and Build Model

The Ministry invites Consortia to submit a tagless tender for Design fees, Margin and Preliminaries and General, based upon a predetermined budget. The tenders are assessed on combination of this total sum and non-priced attributes like quality and previous experience in education projects. At the time of tender, the consortia are not required to provide a design but only identify their costs in developing a 'Master Plan'.

The initial procurement of a Consortium is normally undertaken over a period of a month. Under the current Design and Build (GMP) model all the design and build risk is transferred to the Consortium. The funding, maintenance and running of the school is retained by the Ministry and future Board of Trustees.

The successful Consortium, with the direction from the Establishment Board of Trustees, develops a Master Plan for the school, which includes a Developed Design and a budget based on a Guaranteed Maximum Price (GMP). The duration of this Master Plan development and GMP approval typically takes around six months to complete. If at any stage during the Master Plan development, the Ministry of Education feel that the design or the costs of the projects are not to their expectations, they have the contractual right to dissolve the project. Once the Master Plan is approved by the Ministry of Education, the Consortium undertake to construct and deliver the project to the approved design for the GMP. The Consortium, at the discretion of the Ministry, can alter design items to keep within their GMP.

It has been determined that this process is closely linked to that of PPP procurement and therefore the costs associated with the Master Plan will provide a good basis for a PSC and the anticipated research of this report.

As defined in section 2.8 of the Literature Review, a critical aspect of the development of the PSC is the Output Specification of the project. This is the one item that has the most influence on the potential design outcomes, apportionment of risk and eventual cost of the project.

## 3.4. Methodological Approach

Due to the restrictions on interaction with potential consortia/contractors the author has chosen to undertake a Quantitative approach to this research. A Case Study will be used to develop a PSC and analyse risk for a hypothetical school based on publically available information from the Ministry of Education. Chan, A. et al., (2009) and Li, B. et al., (2005) have both sighted and used case studies to tabulate and analysis risk. The quantitative analysis of this report will be undertaken by way of the following figure:

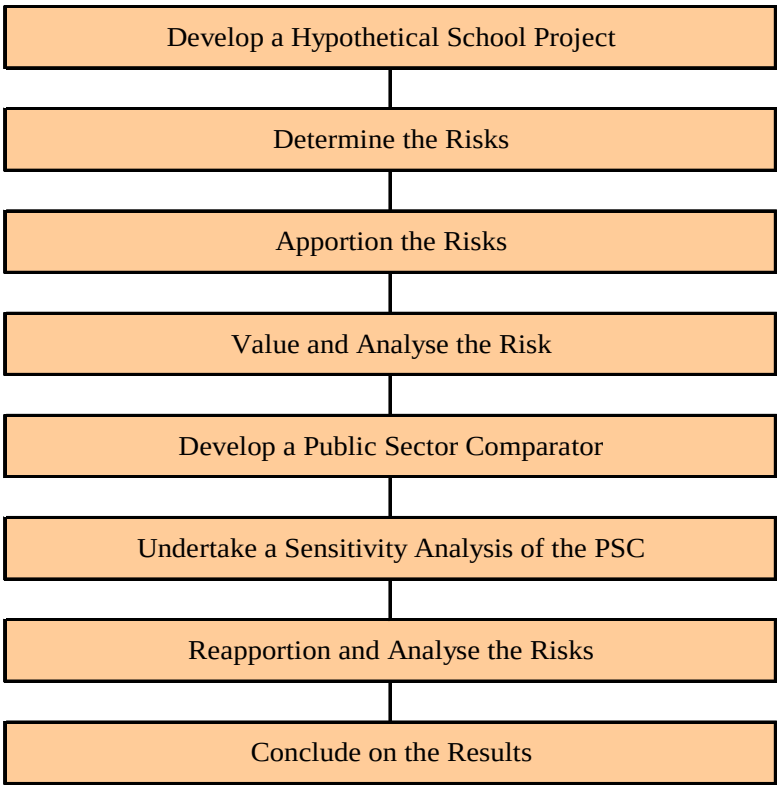



**Figure 4:** Diagrammatic Representation of Report Methodology.

**Development of a Hypothetical School Project**

- A hypothetical secondary school project called Project College will be created. As this is only a hypothetical project the location does not

need to be determined, the site is assumed on a gentle slope typical of current locations of new schools.

- The construction and site component costs for Project College will be developed using the Ministry of Education's project calculators.

**Determine the Risks Associated with PPP Procurement**

- Literature – as previously outlined in the Literature review, there are numerous text that describe the risks associated PPP procurement. These range from Government publications to researchers such as Albert Chan and his associates in their 2009 Journal article on the Drivers for Adopting PPPs'.

**Apportion the Risks to the Public and Private Sectors**

- Using the literature noted previously, each risk will be identified as either a Public (Retained) or Private (Transferred) risk. The tabulated results will be used as the basis for the risk matrix and future reapportionment of the risks. Any risk that is identified as being shared will be clearly defined and excluded if necessary.

**Value and Analyse the Risks Identified in the Literature**

- Using a risk matrix sourced from Ball et al., (2003) the author will be rating risk into Impact and Probability, in a 'simple' risk matrix. These values will be included in a risk register where each risk will be processed against a base cost to give an assumed cost of that risk. These values will be fed into the PSC and analysed.
- The rating of risk will be undertaken from the author's experience. The author has been involved in analysing data that has been included with the development of a PPP as well as assisting the Ministry of Education with procuring new schools under a GMP format. This, knowledge combined with the authors 18 years in the construction industry, should give a basis for the assumptions included in the report.

- As described by Clarke and Hosking (1986), the assessment of probability has been undertaken by using a 'subjective probability' technique that estimates the distribution of outcomes.

**Develop a Public Sector Comparator (PSC)**

- This report will be developing a complete PSC based on the Victorian Partnerships, National Public Private Partnerships Guidelines and a research paper by Lamb et al., (2004). It is specifically noted that the author has developed all the Microsoft Excel spreadsheets that appear in this report, unless referenced.
- This PSC will become the basis of determining the Net Present Cost of the hypothetical project and allow the sensitivity of risks to be analysed.
- Project Construction Costs – as noted above these will be developed using the Ministry of Education's project calculators.
- Life Cycle Costs – the Life Cycle Cost of the school will be determined though the development of a Life Cycle analysis on a trade basis.

**Undertake a Sensitivity Analysis of the PSC**

- Once the baseline PSC has been developed, a sensitivity analysis will be undertaken to show how the Net Present Cost of the PSC is affected by revaluing it at 5% increments between -15% and +15%. This will be shown in both numerical and graphical form.

**Reapportion and Analyse the Risks between the Sectors**

- As a secondary analysis to the sensitivity analysis noted above, the following risks, Design, Finance, Operations – Assets Management and the Site will be reapportioned by transferring them from the Private to the Public Sector and re-valued. Equally, Operations – Staffing will be transferred from the Public to the Private sector.

- This analysis is to show a more detailed way of analysing the Net Present Cost than the simple sensitivity analysis of the PSC.

**Conclude on the Results**

- Once the analysis of risk has been undertaken the report will conclude on the assessments to identify trends and discrepancies.
- The author will then comment on the limitations of the research and identify potential avenues for future research.

## 3.5. Methodology Rationale

**Why a Quantitative Approach?**

As previously discussed, information on risks and their value can not be gathered from consortia/contractors or the Ministry of Education, therefore a Quantitative 'desktop' approach as been determined to analyse literature on risks and their apportionment to the various sectors.

**Why a PSC?**

A PSC is simply an analysis of data with a number of assumptions. Most of the literature sighted has used the PSC to assess risk. The data available will provide a suitable basis for determining risks borne by either the Public or Private Sector and allow further analysis to occur. It is noted that the development of the PSC in the initial stages of a project excludes input from a Consortium, therefore the PSC is based upon Public Sector assumptions. It is the author's intention that the assumptions made within this PSC assessment will be based from a Public perspective.

PPP procurement is relatively new in New Zealand and there are few organisations that have specific expertise or data available to discuss portions of this research with. Currently there are a number of potential projects being investigated by the Government, however the level of information transfer is limited due to the commercially sensitive nature of a PSC. The need to use available literature to develop risks and answer question is intrinsic in this report.

**Why a Case Study?**

Case studies have been sighted in literature by researchers in the determination of risks associated with PPP's. Authors such as Li, B. et al. (2005), Chan et al. (2009) and Jin et al. (2009) have sighted case studies, however in all cases they have used a combination of both Quantitative and Qualitative forms of analysis. These studies relied upon some form of questioning of consortia/contractors to determine the risks to PPP's. It is this reports intention to only use literature to determine suitable risks. The author has recorded over 70 different risks noted within the literature used in this report and is confident that this will give a robust basis for focusing on the top ten risks.

## 3.6. Ethical Considerations

As indicated previously, the author has been involved in a PPP related project for a Government department. It was decided that it would be unwise for the author to speak directly to any construction company/consortium or the Ministry of Education as initially intended. The author had undertaken a vast amount of research before his employer was engaged to work on a PPP in June of this year, which would have meant that this report would have had to cease. It was decided, with the assistance of the author's supervisor, that a desktop exercise based on the literature sighted would be appropriate.

This research report will not require contact or correspondence with anyone or any external party. The research will be based purely on the literature available and publically published documents.

The ethical approval for this research was granted by Unitec Course Co-ordinator Linda Kestle on the 3rd September 2010.

# 4. DATA COLLECTION AND DISCUSSION

## 4.1. Background

This chapter of the report will take the literature and methodology and develop a Risk Register and Public Sector Comparator for a hypothetical school project. As noted in the methodology chapter of this report, risks will be identified from sourced literature and assessed by way of a Risk Matrix. Risk will then be valued and allocated to either the Public or Private sector within the Public Sector Comparator. Specific risk costs will then be reapportioned between the Public and Private sectors to show how this adjustment can affect the resulting value of the Public Sector Comparator.

## 4.2. Introduction

The data for this research was sourced from over 30 pieces of literature and publically published documents. The intention of the following section is to provide a list of potential risks that appear in the development of a Public Private Partnership (PPP) business case and demonstrate how theses risks fit within the development and assessment of a Public Sector Comparator (PSC).

As outlined in the methodology this portion of the report will be split in to the following:

- Development of a Hypothetical School Project
- Determine the Risks of a PPP
- Apportion the Risks to the Public or Private Sectors
- Value and Analyse the Risks identified from the Literature
- Development of a Public Sector Comparator (PSC)
- Undertake a Sensitivity Analysis of the PSC

- Reapportion the Risks Between the sectors and Analyse these risks

The PSC is an extremely complex document, but one that when understood can be very powerful. The PSC is simply a series of spreadsheets that take base values for construction costs, operating costs, valued risk, assumed inflation and adjustments to calculate the Net Present Cost (NPC) of the project. Within the PSC is a vast amount of raw data and assumptions being processed, which is potentially difficult to completely describe, however Figure 5 below shows a simplistic flowchart of data. This chapter will bring all of the components of the PSC together to show how the risks are valued and assessed and how the Net Present Cost is calculated.

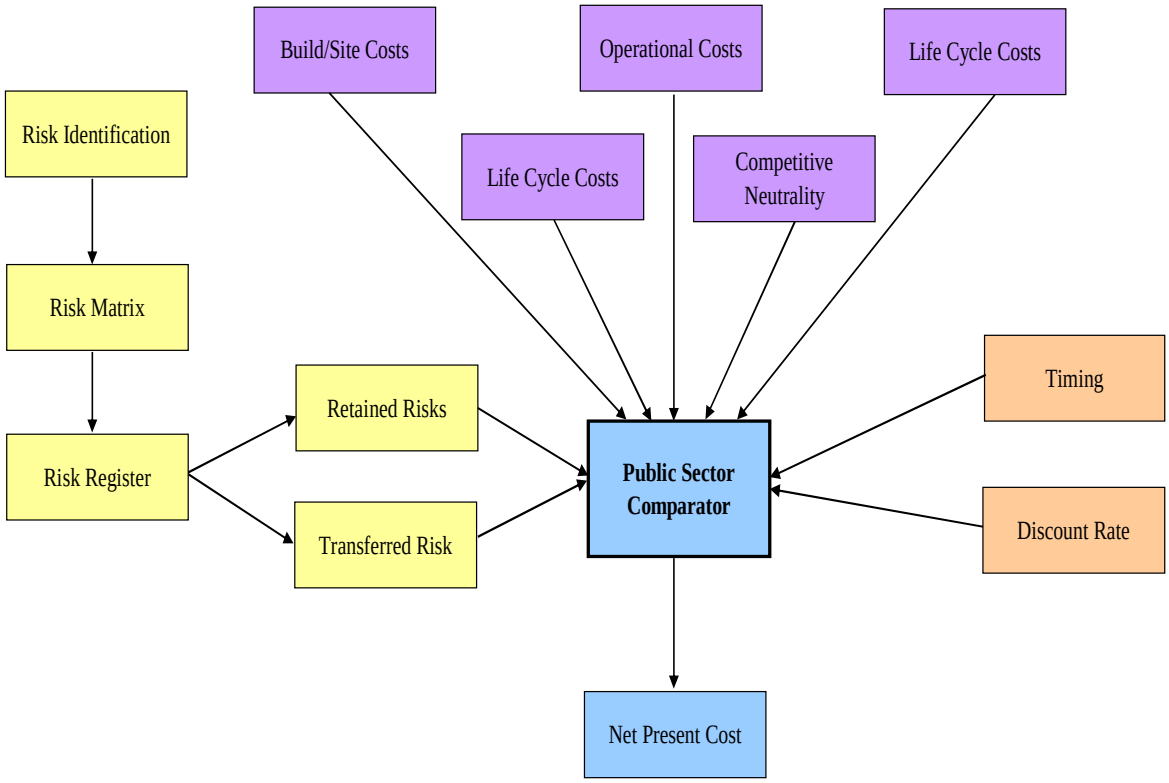



**Figure 5:** Data Flow Chart into the Public Sector Comparator

## 4.3. Development of a Hypothetical School Project

The first task in developing a Public Sector Comparator and determining the Net Present Cost of a PPP project is to create what is called the Raw Public Sector Comparator. This is a spreadsheet that illustrates costs for construction, operations, maintenance and general expenses that would be borne by the Public Sector if it built and operated a school for a period of time. This report has assumed that the PPP contract period has an operating duration of 25 years.

For the purposes of this report the hypothetical school is going to be called Project College.

The next section will define both the construction and operating assumptions included in the Public Sector Comparator (PSC).

**Construction Costs**

The first stage in determining the capital costs of a school is to calculate the area of classrooms and associated facilities. The Ministry of Education's website has online calculators that determine the Gross Floor Area (GFA) of a potential school for a specific roll of students.

Based upon the author's experience of 10 current and previous Ministry of Education projects, a total roll of 1050 students would be appropriate when considering a new state Secondary School. Table 14 on the following page identifies that a roll of 1050 year 9 to 13 (Secondary) students requires a GFA of 10,034m².

This area includes allowances for teaching spaces, administration and resource areas, and library and gymnasium facilities. This rate excludes any potential special allowances for low decile (low social-economic) areas which is not necessary for this level of research.

**Table 2:** Ministry of Education School Property Guide Calculator

## School Property Guide Calculator

Version 2008/09 - 1.4 Single School

**School Information**

| | |
|---|---|
| School number | 100 |
| School name | Project College |
| School type | Year 9- 13 |

**School Roll**

| | Non MI roll | MI roll | Total roll |
|---|---|---|---|
| Year 0 | 0 | 0 | 0 |
| Year 1 | 0 | 0 | 0 |
| Year 2 | 0 | 0 | 0 |
| Year 3 | 0 | 0 | 0 |
| Year 4 | 0 | 0 | 0 |
| Year 5 | 0 | 0 | 0 |
| Year 6 | 0 | 0 | 0 |
| Year 7 | 0 | 0 | 0 |
| Year 8 | 0 | 0 | 0 |
| Year 9 | 0 | 210 | 210 |
| Year 10 | 0 | 210 | 210 |
| Year 11 | 0 | 210 | 210 |
| Year 12 | 0 | 210 | 210 |
| Year 13 + | 0 | 210 | 210 |
| **Total school roll** | | | 1050 |
| ORRS high | | | 0 |
| ORRS very high | | | 0 |
| Outside technology roll | | | 0 |

**School Entitlement**

| | |
|---|---|
| Classroom TS (excl gym) | 56 |
| Gymnasium TS | 2.4 |
| Classroom area | 4,431 |
| Gymnasium area | 947 |
| Library area | 340 |
| Administration area | 745 |
| Resource area | 842 |
| Hall / Multi-purpose area | 412 |
| Total net area | 7,719 |
| **Total gross area** | **10,034** |

The calculation of a budget to construct the buildings for inclusion in the construction section of the PSC can be developed by the use of current Ministry of Education rates and allowances for each portion of the works, as noted in Table 3 on the following page.

Based on the author's experience the area allowances have been assumed for playing fields, hard courts, parking and general circulation. The total assumed site area is 50,000m². Please note that for the purposes of this report the format of the following Table 3 has been developed by the author to mimic the Ministry of Education's area calculator.

**Table 3:** Project Construction Cost

# Budget Calculation

**School Information**

| | |
|---|---|
| School number | 100 |
| School name | Project College |
| School type | Year 9- 13 |

| | | |
|---|---|---|
| Building Area | 10034 | m² |
| Site Area | 50000 | m² |

**Building Construction Cost**

| *Description* | *Qty* | *Unit* | | *Rate* | | *Totals* |
|---|---|---|---|---|---|---|
| Base Build Cost | 10,034 | m² | $ | 2,300 | $ | 23,079,314 |
| Allowance for ESD Factors | 1 | | | 10% | $ | 2,307,931 |
| Allowance for Innovation | 1 | | | 5% | $ | 1,153,966 |
| Lift Allowance | 2 | Item | $ | 100,000 | $ | 200,000 |
| **Total Building Budget** | | | | | **$** | **26,741,211** |

**Siteworks Construction Cost**

| *Description* | *Qty* | *Unit* | | *Rate* | | *Net Totals* |
|---|---|---|---|---|---|---|
| Area of Site | 50,000 | m² | $ | 110 | $ | 5,500,000 |
| Site Specific Allowances | 10,034 | m² | $ | 200 | $ | 2,006,897 |
| **Total Building Budget** | | | | | **$** | **7,506,897** |

**TOTAL PROJECT BUDGET**

| | | |
|---|---|---|
| Building Budget | $ | 26,741,211 |
| Siteworks Budget | $ | 7,506,897 |
| **Total Project Budget** | **$** | **34,248,108** |

Within this budget are allowances for Environmentally Sustainable Design (ESD) and Innovation. These are allowances to reflect the requirement to design and build a school to the New Zealand Green Building Council's Education Tool guidelines, with the expectations that the building gains a Five Star rating.

From the calculation above, the project construction budget is $34,248,108 inclusive of all construction costs, preliminaries & general

costs, margin and contractors contingency. It has been assumed that the design and construction period for the project will be completed in 24 months, with design and architectural supervision continuing for the full period but construction taking 18 months. It is assumed that design/construction would start on 10th January 2011.

Based on previous projects undertaken by the author, this budget is sufficient. All of the rates and allowances identified above are published on the Ministry of Education website.

**Operating Assumptions**

The total value of the operating costs over the life of the project, in this case 25 years, is based upon 'today's prices'. As described previously, the result of the Public Sector Comparator (PSC) is the Net Present Cost of the project. The operating costs are the largest portion of the total cost to the project over its lifetime, and the PSC attempts to value these costs now and in the future.

Unlike the construction costs that will be expended during the first few years of the PPP contract, operating costs will run from the time the school is opened until the PPP contract has been completed i.e. after 25 years of operation.

For the purposes of the PSC, operating costs are determined and assumed from historical cost information. The author has used published material to assume the potential cost the Ministry of Education would have to expend to operate the school.

These assumptions are summarised in Table 4 on the following page. The full list of assumptions are included in Appendix Two.

**Table 4:** Project Operation Costs and Assumptions

| GENERAL ASSUMPTIONS | Assumption | Comments |
|---|---|---|
| CPI Rate | 2.50% | |
| Discount Rate (Real Return) | 3.50% | Rates sourced from NZ Treasury - July 2010 |
| Discount Rate (Nominal) | 6.00% | |
| Capital Start Date | 1 January 2011 | |
| Capital End Date | 30 December 2012 | Capital Period 2.0 Years |
| Operation Start Date | 1 January 2013 | |
| Operation End Date | 31 December 2037 | Operation Period 25.0 Years |
| Project Name | Project College | |

| CAPITAL COSTS | Assumption | | Comments |
|---|---|---|---|
| **Direct Capital Costs** | | | |
| Land Acquisition and Development | $ | 5,000,000 | Assumes land cost of $5,000,000 for green field site |
| Site Works | $ | 7,506,897 | Assumes site area of 50,000m² |
| Construction Price | $ | 26,741,211 | Assumes that design and construction will take 24 months |
| Technical Consultants Allowance | $ | 513,722 | Assumes 1.5% of Development Budget |
| Consultant Fees for Reference Project | $ | 1,712,405 | Assumes 5% of Development Budget |
| Plant and Equipment Acquisitions | $ | 3,424,811 | Assumes a 10% of the cost of the development for FF&E |
| Required through-life capital expenditure | $ | 16,364,066 | Applied as per the Life Cycle Costing Model |
| **Indirect Costs** | | | |
| Construction Overheads | $ | 267,412 | Assumed as 1% of construction cost |

| OPERATING AND MAINTENANCE COSTS | Assumption | | Comments |
|---|---|---|---|
| **Direct Maintenance Costs** | | | |
| Maintenance Costs (annual) | $ | 451,552 | Assumed as $45/m² of GFA, based on Ministry 5YA average funding |
| **Direct Operating Costs** | | | |
| School Executive Costs | $ | 529,233 | |
| Teaching Staff Costs | $ | 2,396,924 | $ 3,158,157 |
| Other Staff Costs | $ | 232,000 | |
| Electricity | $ | 99,245 | |
| Water | $ | 80,083 | |
| Telecommunications | $ | 12,000 | $ 443,223 |
| Facilities Management | $ | 239,895 | |
| Insurances | $ | 12,000 | |
| **Indirect Operating Costs** | | | |
| Operating overheads (annual) | $ | 15,000 | |
| Administrative overheads | $ | 10,000 | |
| **Third Party Revenue** | | | |
| Anticipated Third Party Revenue | $ | 208,125 | |
| **Total Costs** | **$** | **4,286,057** | |

It must be noted that in a ‘real life’ PPP business case assessment by the Public Sector, these costs would be based on actual historical data. For the purposes of this report and because it was deemed inappropriate for the author to contact the Ministry of Education to investigate the true costs for a school, these costs are purely assumptions. Even though there is a potential risk in under/over estimating these costs, the purpose of this report is to assess the interactions of risk, and these assumptions of the base operating costs will allow this to occur.

Once all of the operating costs are valued, the figures can be included in the Raw Public Sector Comparator spreadsheet as described in section 4.7 of this report.

## 4.4. Determination of Risks

Through the research of literature, this report has identified a large number of risks ranging from construction to financial and environmental risks, many of which have also been allocated to either the Private or Public sector. Table 5 on the following page identifies and ranks risks in terms of the number of individual sighting (summarised in some cases) from their respective authors.

This table highlights and ranks those risks that appeared in the literature more than twice, and illustrates that there is a partial consensus (of the authors) of the common risks within Public Private Partnership procurement. The leading number of sightings was Construction Risk (13 sightings) and the lowest was Inflation Rate Volatility and Timeliness (two sightings each). The top ten risks have been highlighted in light green.

**Table 5:** Risk Literature Sightings

| RISKS SIGHTED | REFERENCE LITERATURE | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bing, L et al. (2005) | Brady, K.B, (2006). | Cartridge et al. (2006) | Grimsey, D. et al. (2005) | Infranews (2006) | Jefferies, M et al. (2008) | Jin, X.H. (2009) | Jin, X.H et al. (2008) | Khadaroo, I. (2008) | Lonergan, R. (2004). | Lonergan, R. (2004). | National Audit Office. (2009) | NSW Auditor General. (2006). | Ng, A. et al. (2007) | Partnerships Victoria (2001) | Quiggin, J. (2004) | Waterview Steering Committee (2008) |
| Construction Risks | x | x | x | x | | x | x | | x | | x | | x | x | x | x | x |
| Demand for the Asset | x | x | x | | x | | | | | x | | | | | x | x | x |
| Design Risks | | x | x | | x | x | | | | | | | x | | x | x | x |
| Environmental | x | | | | | x | | | | | | | | x | x | | |
| Employees | | | | | x | | | | | | | x | | | x | | |
| Financing | x | x | | | | x | x | | | | x | x | | x | x | | |
| Force majeure | x | | | | x | | | | x | x | x | | | | x | | x |
| Interest rate volatility | x | | | | | | | | | | | | x | | | | |
| Inflation | x | | | | | | | | | x | x | | | | | | |
| Market Risks | x | | | | | x | | | | x | | | | | | | x |
| Maintenance costs | x | x | | | | x | | | | x | x | | | | | | |
| Operating the Asset | x | | x | | | x | | | x | | x | | x | | x | x | x |
| Policy/Regulatory Changes | x | x | | | | | | | x | x | | | | | x | x | x |
| Political opposition | x | | | | | x | | | | | x | | | | | | |
| Poor public decision making | x | | | | | | | x | | | | | | | | | |
| Public opposition to project | | | | | | | | x | | | x | | | | | | |
| Revenue from the Asset | | x | x | | | x | | | | x | | | x | x | | | |
| Technology and Obsolesce | | x | | | | x | | | | | x | | | | x | | |
| The Site | x | | | | x | x | | | x | | | | | | | | x |
| Timeliness | | | | | | | | | x | x | | | | | | | |

A full list of all the documented risks is included in Appendix Two of this report.

In some cases, risks that would not apply to the New Zealand construction industry or educational environment have been excluded by the author from this literature table. There were two sightings of Unsuitable Government risk possibly effecting PPP procurement. In the New Zealand context, this would have a minimal chance of occurring considering the economies current stability, therefore has been excluded.

The majority of the literature sighted used a mixture of Quantitative and Qualitative method to extract these risks. The studies also used various surveys to identify and rate the identification of risk.

From the literature matrix on the previous page, the top ten risks have been identified, in alphabetic order, as:

- Construction Risks
- Demand for the Asset
- Design Risks
- Financing
- Force majeure
- Maintenance costs
- Operating the Asset
- Policy/Regulatory Changes
- Revenue from the Asset
- The Site

In the next section, these top ten identified risks will be further assessed and apportioned to either the Public or Private sectors.

In many cases, the aforementioned risks were often sighed as headings for a range of similar risks. For example, construction risk often included such subheadings as material prices, resources and time delays. It has been outlined by the National PPP Guidelines (2008) that identifying and valuing risk as a

high level heading, such as ‘construction’, will, in certain circumstances, give a suitable basis for the development of a risk matrix and the PSC.

The assessment of these underlying items or sub-headings, is pertinent but could depend upon the level of documentation that is available to the Public Sector during their development of the PSC. If for example, a hypothetical project based on a minimal output specification, as described in section 2.8 and as is the case for this report, the assessment of individual construction components i.e. façade elements or the duration to construct them, would not be documented. It would be difficult it assume these kinds of intricate details under a minimal output specification.

It may be necessary to consolidate a variety of risks into one heading or general assumption based upon a potential questions such as, *‘how long would it take to construct a building of 10,034m² and what is the risk of a competent contractor not being able to construct it in 12 months’*

On the other hand, if a Full Specification is developed for a hypothetical project, individual risk items can easily be assessed and valued. This will be discussed further, but output based assessment of risk is a potential inaccuracy in valuing risk and producing a robust Public Sector Comparator.

## 4.5. Apportionment of Risk

Following the identification of risks, the next step in determining the value of risk is to apportion each risk to either the Public or Private sector. Identification and apportionment is intrinsic to the development of the PSC and this report. Authors such as Chan, (2009) have used a similar format as that used in Table 6 on the next page, to determine a specific sector to apportion risk. Correct apportionment is sighted by Bing et al., (2004), Li (2009) and Lamb et al.,

(2004) as necessary to identify which sector will assume and price the risks within the project the most efficiently. Literature has identified these apportionments based on both historical information and Qualitative studies.

**Table 6:** Apportionment of Risk Based on a Literature Search

| RISKS SIGHTED | REFERENCE LITERATURE | | | | | | | | | | | | | | PERCENTAGE MIX | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bing, L et al. (2005) | Brady, K.B, (2006). | Cartridge et al. (2006) | Infranews (2006) | Jefferies, M et al. (2008) | Jin, X.H. (2009) | Khadaroo, I. (2008) | Lonergan, R. (2004). | Marques, R. et al. (2009) | NSW Auditor General. (2006). | Ng, A. et al. (2007) | Partnerships Victoria (2001) | Quiggin, J. (2004) | Waterview Steering Committee (2008) | Public Sector | Private Sector | Shared | Not Identified |
| Construction Risks | X | X | PT | | PT | PT | PT | | PT | PT | PT | PT | PT | PT | 0% | **83%** | 0% | 17% |
| Demand for the Asset | PT | X | PB | PB | | | | PT | | | | PT | PB | PT | 38% | **50%** | 0% | 13% |
| Design Risks | | X | PT | PT | PT | | | | | PT | | PT | PB | S | 13% | **63%** | 13% | 13% |
| Financing | PT | X | | | PT | PT | | | PB | | PT | PT | | | 14% | **71%** | 0% | 14% |
| Force majeure | X | | | S | | | PT | X | X | | | S | | X | 0% | 14% | 29% | **57%** |
| Maintenance costs | PT | X | | | PT | | | PT | PT | | | | | | 0% | **80%** | 0% | 20% |
| Operating the Asset | PT | | PT | | PT | | PT | | PT | PT | | PT | PT | PT | 0% | **100%** | 0% | 0% |
| Policy/Regulatory Changes | PB | X | | | | | PB | PB | | | | X | PB | PT | **57%** | 14% | 0% | 29% |
| Revenue from the Asset | | X | PT | | PT | | | PT | | PB | PT | | | | 17% | **67%** | 0% | 17% |
| The Site | PT | | | PT | PB | | PT | | | | | | | X | 20% | **60%** | 0% | 20% |

**LEGEND**

| PB = PUBLIC SECTOR | PT = PRIVATE SECTOR | S = SHARED | X = NOT IDENTIFIED |
|---|---|---|---|

From the apportionment matrix the risks can be allocated to the following sectors:

**Public Sector**

- Policy/Regulatory Changes

**Private Sector**

- Construction Risks
- Demand for the Asset
- Design Risks
- Financing
- Maintenance costs
- Operating the Asset
- Revenue from the Asset
- The Site

**Shared Risk**

- Force Majeure

Tables 5 and 6 identify a series of risks that would generally be assessed and valued if a report was being undertaken with a Quantitative study, but because this report is being undertaken through a Qualitative study, the above risks need to be clarified, and in some cases excluded from the assessment of risk and inclusion in the PSC. These are as follows:

**Clarified Risks**

- **Operational Risks**
  - In assessing 'Operating the Asset', it is necessary to split this into Staff Operations and Asset Management to reflect the Governments indications that operating the staffing of a school would not be transferred to the Private Sector. However, it is the intention of this report that this risk will be transferred to

the Private Sector, as it is acknowledged that the cost of staffing is potentially the largest cost to a project over the life of a contract. It is postulated that the sensitivity of altering this cost could have a dramatic effect on the value and potential Service Payments of the project.

**Excluded Risks**

- **Demand Risks**
  - The assessment of demand risk is difficult for a school as there is no tangible dollar return on money 'invested' in it. A few PPP procured schools in the UK have specific targets that they must meet, that determines their 'students attainment' Rintala (2009), however there is no assessment of the actual cost of this attainment.
  - The Ministry of Education funds a school based upon its roll and any changes to this roll affect both its funding for maintenance (through Five Year Agreement '5YA' funding) and their classroom allotment. A decrease in roll could mean that a school does not have enough funds to pay for the upkeep of the school or potentially it could have a classroom space removed. It has been assumed that there would be little chance of the roll decreasing in the initial years of the new schools inception.
  - If this risk was retained by the Public sector, it is the author's assumption that there would be no cost.
  - If this was a transferable risk, then the private sector would have to include a sum for covering costs if the roll decreases. The issue here would not be the loss of any classrooms, but the potential decrease in Service Payment or potentially a breach of contract, as it is assumed that part of the contract between the Public and Private sectors would include some form of minimum roll. If for example, the roll

did decrease, the Private Sector would be required to increase the roll or it would be in breach of its contract and could have its Service Payments decreased.

- The assessment of the value of demand for a school has been seen by the author as too subjective, therefore this has been excluded from the assessment of risk and the PSC.

- **Financing Risks**
  - Financing risk has been sighted by many such as Grimsey et al., (2003) as the risk of not being able to obtain the necessary funding or on the opposite side, having the ability to refinance during the life of the project at a cheaper rate. The actual cost of financing is excluded from the assessment of the PPP because it is often assumed that a potential consortium will not fund the project from borrowing but have some form of equity that would finance it during the duration of the project. The National PPP guidelines also exclude any mention of financing costs from their PSC.
  - From the literature, it appears that the assumptions on the risks associated of procuring the financing can also be very subjective and will depend upon the makeup of the financial section of the consortium. For these reasons financing has been specifically excluded from the assessment of risk.

- **Force Majeure Risks**
  - The allocation of Force Majeure has been identified by the above authors as a shared risk, however it is noted that it is often difficult to value this risk, as it depends on factors such as ‘acts of God’ which could potentially occur but the assumption would be extremely subjective and the author would only be guessing.

- For the purposes of this report, this risk has been excluded from assessment or inclusion in the PSC as the probability for error is high and the potential value low enough that it would not alter the PSC assessment.

Based on the literature review of the risks and the above clarifications and exclusions, the following risks will be valued and fully assessed in this report:

- Construction Risk
- Design Risk
- Maintenance
- Operations – Asset Management
- Operations – Staffing
- Policy Changes
- Revenue form the Asset
- The Site

It must be noted that the initial allocation of risk is a reference point for this report and the development of the PSC. The author intends to show how altering the transfer of risk affects the value and sensitivity of the PSC. To include each risk into the PSC it is now necessary to value them in terms of a cost to the project.

## 4.6. Valuing and Analysis of Risk

Academics such as Spackman (2002) have identified statistical equations and sighted the need to link risk assessment to income, and in some cases people's perceptions are "influenced by many complex factors such as fairness and blame." (Page 292). As noted previously, the author's employer was engaged by a Government Department as a consultant to advise on Public Private

Partnership (PPP) related issues. As part of the engagement the author was required to sign a confidentiality statement, therefore the author considered it inappropriate to discuss risks with consortia/construction companies or the Ministry of Education. This report will therefore use research and the authors experience to rate the risks.

In valuing risk Partnerships Victoria (2001) outlined that the:

**Value of Risk = Consequence x Probability of Occurrence + Contingency**

The 'Consequence' or 'impact', could be apparent and assuming the contract included clear 'punishments' for non performance, this could be measured. In this instance the consequence/impact is the costs borne by the project i.e. increased construction costs due to delay etc. The 'probability of the risk occurring' can be gauged by using a statistical analysis. Partnerships Victoria notes that the difficulty in assessing the financial impacts of risks lead to the inclusion of contingencies, while still being conscious of the risk being cost effective.

The contingency has been sighted by authors such as Ball et al., (2003) as not being necessary as it is another assumption that needs to be substantiated. The author agrees with the Ball et al., comments. For the purposes of determining a base risk value that can be changed and analysed, a contingency has been excluded from the value of risk. If nothing more, the inclusion of a contingency shows how many assumptions are in a PSC and potentially how inaccurate it can be.

Each risk identified in sections 4.4 and 4.5 now needs to be placed into a risk matrix based on Ball et al., (2003) as shown in the example in Figure 6 on the following page.

A risk is separated into three scenarios, Below Base (Blue), No Deviation (Green) and Above Base (Purple). Each risk attracts a certain percentage of impact and probability i.e. the location of the coloured dot. The location of the dot is the estimate of the risk by the person assessing it. By moving the coloured dots, the percentages of Impact and Probability will change.

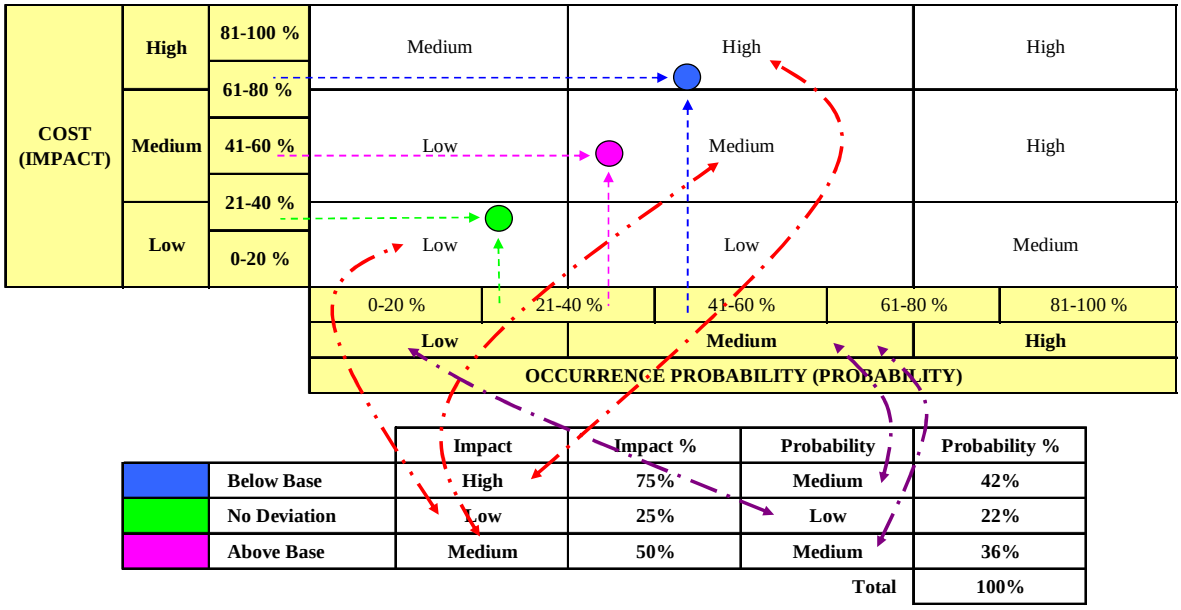



**Figure 6:** Risk Matrix Based on Ball et al., (2003).

In Figure 6, the Below Base Risk (in Blue) has a High impact on the project cost and a Medium probability of it occurring (identified by the blue dotted lined). The percentages for each are determined by estimating where these are positioned on the scale of percentages. Once again, Below Base Risk would have a 75% impact on the project cost and the probability of this occurring is 42%.

These percentages are important because they allow the risk register and the equation provided by the Victorian Partnership, to put a price on the risk. This valuing of risk will be described later in this section.

The following tables are a summary of the assumptions the author has used to assess the risk and the actual risk matrix from the Public Sector Comparator spreadsheet for each of the identified risks. It must be specifically noted that the rating of risk and the placement of the 'dots' on the risk matrix is the authors choice. The position of these dots could be completely different if the assessment was made by another assessor.

### Construction Risks

Construction risk includes such risks as would normally be identified during the construction phase of a project. These risks can include material prices, inaccurate pricing, delays, staffing issues and productivity. From literature such as Marques et al (2009) and Bing et al (2004), and the author's experience, it has been decided that the most important factor is a delay to the works.

**Table 7:** Construction Risk Matrix

| | | | | | | |
|---|---|---|---|---|---|---|
| **COST (IMPACT)** | **High** | **81-100** | Medium | High | | High |
| | | **61-80** | | | | |
| | **Medium** | **41-60** | Low | Medium | | High |
| | | **21-40** | | | | |
| | **Low** | **0-20** | Low | Low | | Medium |
| | | | 0-20 | 21-40 | 41-60 | 61-80 | 81-100 |
| | | | **Low** | **Medium** | | **High** |
| | | | **OCCURRENCE PROBABILITY (PROBABILITY)** | | | |

| | | Impact | Impact % | Probability | Probability % |
|---|---|---|---|---|---|
| | **Below Base** | **Low** | **10%** | **Low** | **25%** |
| | **No Deviation** | **Low** | **0%** | **Medium** | **35%** |
| | **Above Base** | **Medium** | **45%** | **Low - Medium** | **40%** |
| | | | | **Total** | **100%** |

A below base assessment would reflect that the project was delivered under budget and within programme. An above base assumption reflects

the project running over budget, where the cost is managing the project past the completion date.

### Design Risks

Design for a school project is normally determined by the pedagogy of the Board of Trustees that are establishing the school. The way the Board wants the learning environment to be will therefore affect the amount of space for teaching area, i.e. standard classrooms or learning commons (large open plan areas for approximately 100 students). The risk is that the design team or the Board may simply get this wrong and the design may falter or require reworking.

**Table 8:** Design Risk Matrix

| | | | | | |
|---|---|---|---|---|---|
| **COST (IMPACT)** | **High** | **81-100** | Medium | High | High |
| | | **61-80** | | | |
| | **Medium** | **41-60** | Low | Medium | High |
| | | **21-40** | | | |
| | **Low** | **0-20** | Low | Low | Medium |
| | | | 0-20 | 21-40 | 41-60 | 61-80 | 81-100 |
| | | | **Low** | **Medium** | **High** |
| | | | **OCCURRENCE PROBABILITY (PROBABILITY)** | | |

| | | Impact | Impact % | Probability | Probability % |
|---|---|---|---|---|---|
| | **Below Base** | **Low** | **5%** | **Low** | **10%** |
| | **No Deviation** | **Low** | **0%** | **Medium** | **50%** |
| | **Above Base** | **Medium** | **50%** | **Medium** | **40%** |
| | | | | **Total** | **100%** |

The design risk has been assumed as factors that affect the project from obtaining it original design intent. A below base risk would mean that the design was completed within the allocated design and exceed the original scope, whereas an above base assessment would mean that the design

required many reiterations and the final product did not reflect the concept.

### Maintenance costs

Risk in maintenance costs would arise from the consortium designing or constructing materials that are not fit for purpose or have a low level of maintenance.

**Table 9:** Maintenance Risk Matrix

| | | | | | | |
|---|---|---|---|---|---|---|
| **COST (IMPACT)** | **High** | **81-100** | Medium | High | | High |
| | | **61-80** | | | | |
| | **Medium** | **41-60** | Low | Medium | | High |
| | | **21-40** | | | | |
| | **Low** | **0-20** | Low | Low | | Medium |
| | | | 0-20 | 21-40 | 41-60 | 61-80 | 81-100 |
| | | | **Low** | **Medium** | | | **High** |
| | | | **OCCURRENCE PROBABILITY (PROBABILITY)** | | | | |

| | | Impact | Impact % | Probability | Probability % |
|---|---|---|---|---|---|
| | **Below Base** | **Medium** | **50%** | **Low** | **10%** |
| | **No Deviation** | **Low** | **0%** | **Low** | **25%** |
| | **Above Base** | **High** | **80%** | **Medium** | **65%** |
| | | | | **Total** | **100%** |

A below base risk would reflect a decreased requirement to maintain the building due to the superior materials used. An above base reflects poor materials or design requiring more maintenance that originally required.

### Operating the Asset - Staff Operations

As noted previously, the Government has indicated that the staffing will not be transferred to a consortium, therefore the author has retained this portion of operating the risk. The risk is assumed as any industrial action and pay increases that would affect the Public Sectors ability to provide

the staffing and having the school open for the required number of days, which would be assumed as an intrinsic part of their requirements under the contract and the Service Payments.

**Table 10:** Staffing Operations Risk Matrix

| COST (IMPACT) | | | | | |
|---|---|---|---|---|---|
| | High | 81-100 | Medium | High | High |
| | | 61-80 | | | |
| | Medium | 41-60 | Low | Medium | High |
| | | 21-40 | | | |
| | Low | 0-20 | Low | Low | Medium |
| | | | 0-20 | 21-40 | 41-60 | 61-80 | 81-100 |
| | | | Low | Medium | High |
| | | | OCCURRENCE PROBABILITY (PROBABILITY) | | |

| | | Impact | Impact % | Probability | Probability % |
|---|---|---|---|---|---|
| | Below Base | Low | 0% | Low | 20% |
| | No Deviation | Low | 0% | Low | 10% |
| | Above Base | Medium | 40% | High | 70% |
| | | | | Total | 100% |

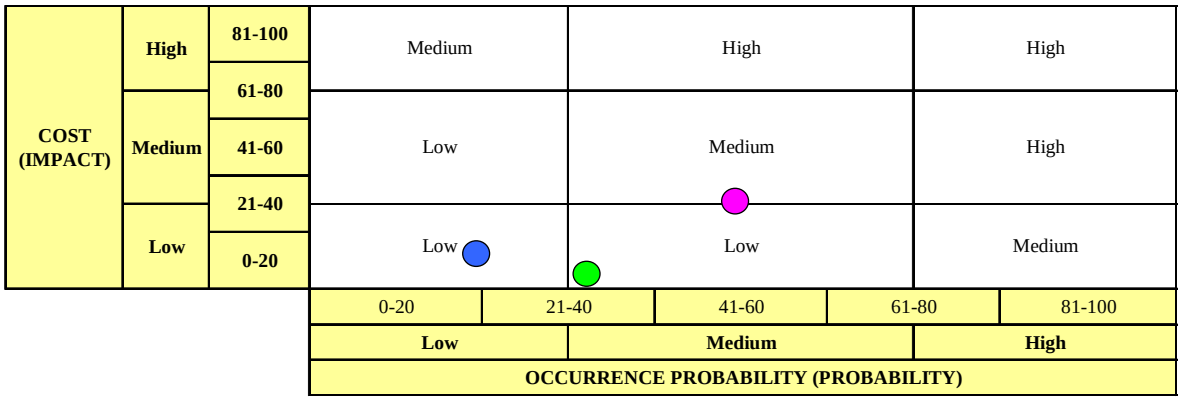
A below base assumption indicates that salaries would decrease and industrial action would be non existent, which has been assumed as extremely unlikely. An above base assumption reflects wages rising by more than inflation and continued industrial action. Based on the current teachers pay negotiations reported by the media as being stalled and previous industrial action, this is a high risk.

### Operating the Asset - Asset Management Operations

This risk reflects the daily operation and running costs of the school in terms of utilities, maintenance and general running costs. The typical way that a school is funded maintenance is through Ministry 5YA funding and a 10 Year Property Plan (10YPP), which the author has been directly involved with. This forward planning of anticipating what the school

property will require over the next 10 years is not an exact science and in reality if the forecasting is incorrect, works just do not get completed, as further funding is not always granted.

**Table 11:** Asset Operations Risk Matrix




| | | Impact | Impact % | Probability | Probability % |
|---|---|---|---|---|---|
| | Below Base | Low | 10% | Low | 20% |
| | No Deviation | Low | 0% | Medium | 30% |
| | Above Base | Low - Medium | 30% | Medium | 50% |
| | | | | Total | 100% |

The author has assumed that the project has the industries standard maintenance programs in place, therefore a below base assessment reflects operating costs being below the forecast level, and would reflect cost cutting exercises. An above base assessment reflects cost increasing beyond expectations, and could be attributed to either higher costs for utilities or poor design, and a requirement to maintain the property more.

### Policy/Regulatory Changes

As noted in the literature this is also a retained risk.

A below base assumption reflects the site is designated for a school and there is public interest in the school being provided. It has been assessed

that there would be a small chance of this occurring but the cost impact would be zero.

**Table 12:** Policy Regulatory Changes

| | | | | | | |
|---|---|---|---|---|---|---|
| **COST (IMPACT)** | **High** | **81-100** | Medium | High | High | |
| | | **61-80** | | | | |
| | **Medium** | **41-60** | Low | Medium | High | |
| | | **21-40** | | | | |
| | **Low** | **0-20** | Low | Low | Medium | |
| | | | 0-20 | 21-40 | 41-60 | 61-80 | 81-100 |
| | | | **Low** | **Medium** | **High** | |
| | | | **OCCURRENCE PROBABILITY (PROBABILITY)** | | | |

| | | Impact | Impact % | Probability | Probability % |
|---|---|---|---|---|---|
| | **Below Base** | **Low** | **0%** | **Low** | **20%** |
| | **No Deviation** | **Low** | **0%** | **Low** | **20%** |
| | **Above Base** | **Medium** | **50%** | **Medium** | **60%** |
| | | | | **Total** | **100%** |

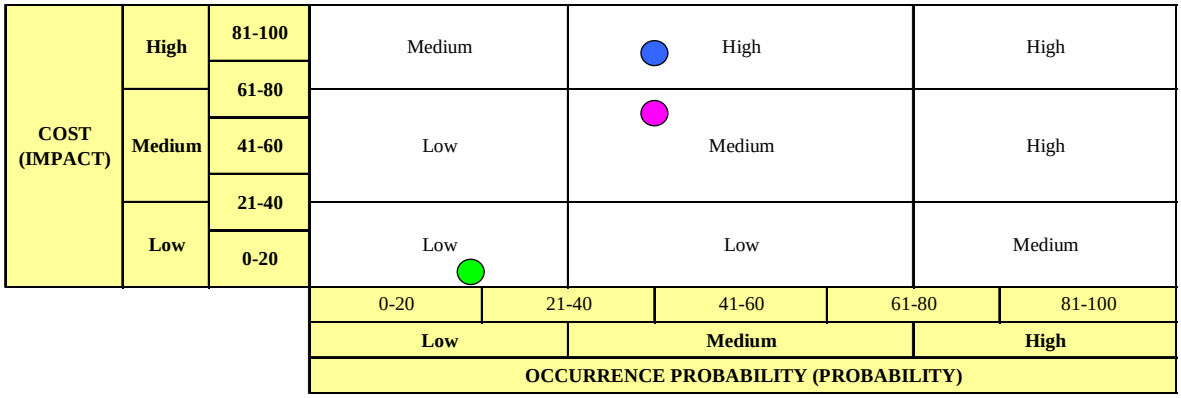
An above base assessment assumes that the site will not be designated for a school or the designation is revoked or challenged by the public. This would lead to an extension to the project time frame and increased costs to alter the designation, district plan or engage legal representation to have the project considered through the Environmental Court.

### Revenue from the Asset

The revenue source from the asset would be collected from the properties use outside of schooling hours. It is clearly visible by visiting various schools that they provide not only after school care but holiday programmes and extra curriculum activities and in some cases adult night school classes, all of which attract revenue stream for the school. The ability of a school to gain revenue from out of zone or international students has been excluded from this assessment as the revenue is

confidential and would distort the results as there are only a select few schools that operate in this manner.

**Table 13:** Revenue form the Asset




| | | Impact | Impact % | Probability | Probability % |
|---|---|---|---|---|---|
| | Below Base | High | 80% | Medium | 20% |
| | No Deviation | Low | 0% | Low | 40% |
| | Above Base | Medium | 65% | Medium | 40% |
| | | | | Total | 100% |

A below base assessment would mean that this revenue is higher than projections and the above base was below projections. This reversal compared to the previous risks reflects that if the property attracts extra revenue, which counteracts any costs associated with the risk.

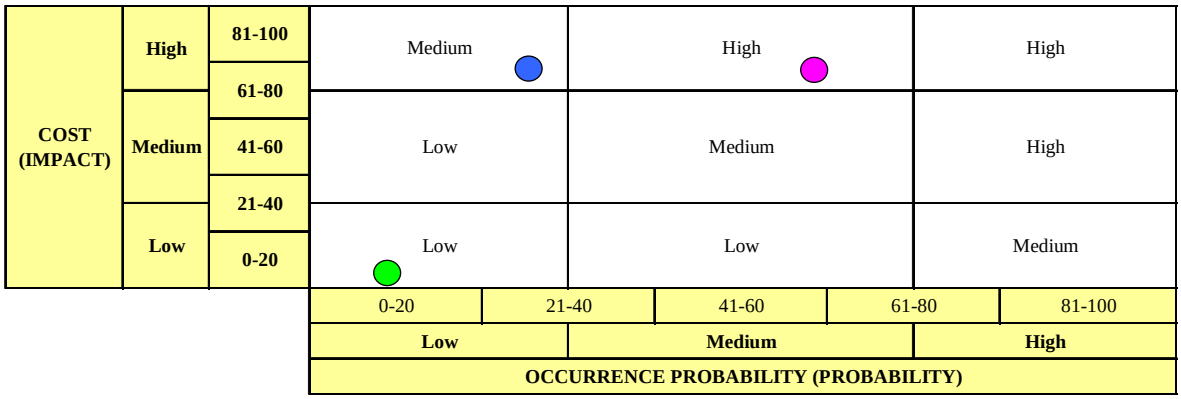
## The Site

The author has observed that in the past, the Ministry of Education has purchased school sites out of possible necessity, rather than through researched long term planning. This has led to a raft of issues, none more than having to expend a vast amount of money adjusting a steep gradient site to a useable platform.

Basically, a site must have a reasonably low gradient or the cost of developing the site to overcome retaining and bulk earthworks increases.

In recent times, the Ministry of Education has undertaken a more standardised level of due diligence in purchasing sites for schools, which has taken some of the risk out of the overall development costs.

**Table 14:** The Site




| | | Impact | Impact % | Probability | Probability % |
|---|---|---|---|---|---|
| | Below Base | High | 80% | Low | 30% |
| | No Deviation | Low | 0% | Low | 10% |
| | Above Base | High | 80% | Medium | 60% |
| | | | | Total | 100% |

Based on the literature, the site has been assumed as being a Transferred risk within the Risk Adjusted PSC. It has been assumed that site risks include items such as geological and civil issues.

As defined in the Chapter 3 of this report there are documented problems with risk matrices to assess risk (Mokhtari et al., 2005), as the assessments are often very subjective. From the authors experience in developing risk matrixes and attempting to determine a value of a risk, it is acknowledged that this assessment of risk gives a ‘simple’ value. It would have been preferable to use a statistical matrix to determine the value of risk based on a number of questioned construction professionals and the Ministry of Education, but this was not possible due to limits on the author’s interactions with consortia and

the Ministry of Education. It has been decided that the basic intent of this report is to set a benchmark of risk, which can be provided by a simple risk matrix.

For the development of a robust PSC, the author's assumptions on the valuation of risk are very important. Various techniques have been described in the literature sourced for this report. For example, Li, B. (2009) has identified valuing risk with statistical analysis and risk modelling. The New Zealand Government references the 'Australian and New Zealand Risk Management Standard NZS4360:2004: Risk Management'.

Table 15 on the following page, is the developed risk register. This identifies each risk and comments on when the risk would be realised during the contract period. The full table is included in Appendix Two

The value of risk is calculated by multiplying the Base Cost by the Impact by the Probability. For example the valuation of the Policy Changes Risk in a situation where it is Above the Base is:

**Base Cost x Impact % x Probability % = Above Base Policy Changes Risk**

**or**

**$500,000 x 50% x 60% = $150,000**

**Table 15:** Risk Register

**RETAINED RISK**

| Risk | Description of Risk | Consequence | Base ($) | Scenario | Impact | Probability | Value |
|---|---|---|---|---|---|---|---|
| **Policy/ Regulatory Changes** | Issues with District Plan or Designation changes. | Cost increase | 500,000 | Below Base | 0% | 20% | - |
| | | | | No Deviation | 0% | 20% | - |
| | | | | Above Base | 50% | 60% | 150,000 |
| | | | | **Subtotal** | | **100%** | **150,000** |
| **Operations - Staffing** | Changes in wage costs and industrial action | Cost increase and Disruption of Services | 3,158,157 | Below Base | 0% | 20% | - |
| | | | | No Deviation | 0% | 10% | - |
| | | | | Above Base | 40% | 70% | 884,284 |
| | | | | **Subtotal** | | **100%** | **884,284** |
| **TOTAL RETAINED RISK** | | | | | | | **1,034,284** |

**TRANSFERRED RISK**

| Risk | Description of Risk | Consequence | Base | Scenario | Impact | Probability | Value |
|---|---|---|---|---|---|---|---|
| **Construction Risk** | Construction issues due to delay and increase costs of building | Cost Increase | 26,741,211 | Below Base | -10% | 25% | (668,530) |
| | | | | No Deviation | 0% | 35% | - |
| | | | | Above Base | 45% | 40% | 4,813,418 |
| | | | | **Subtotal** | | **100%** | **4,144,888** |
| **Design Risk** | Design not complying with guidelines or not a suitable environment | Revenue | 2,563,591 | Below Base | -5% | 10% | (12,818) |
| | | | | No Deviation | 0% | 50% | - |
| | | | | Above Base | 50% | 40% | 512,718 |
| | | | | **Subtotal** | | **100%** | **499,900** |
| **Maintenance** | Issues with the specified materials or structure lead to constant repairs | Cost Increase | 451,552 | Below Base | -50% | 10% | (22,578) |
| | | | | No Deviation | 0% | 25% | - |
| | | | | Above Base | 80% | 65% | 234,807 |
| | | | | **Subtotal** | | **100%** | **212,229** |
| **Operating - Asset Management** | Changes in operation costs such as Power and Water etc | Cost Increase | 443,223 | Below Base | -10% | 20% | (8,864) |
| | | | | No Deviation | 0% | 30% | - |
| | | | | Above Base | 30% | 50% | 66,483 |
| | | | | **Subtotal** | | **100%** | **57,619** |
| **Revenue for the Asset** | Third party revenue from the School | Cost increase and Disruption of Services | 208,125 | Below Base | -80% | 20% | (33,300) |
| | | | | No Deviation | 0% | 40% | - |
| | | | | Above Base | 65% | 40% | 54,113 |
| | | | | **Subtotal** | | **100%** | **20,813** |
| **The Site** | Site development and construction risk | Cost Increase | 7,506,897 | Below Base | -80% | 30% | (1,801,655) |
| | | | | No Deviation | 0% | 10% | - |
| | | | | Above Base | 80% | 60% | 3,603,311 |
| | | | | **Subtotal** | | **100%** | **1,801,655** |
| **TOTAL TRANSFERRED RISK** | | | | | | | **$ 6,737,104** |

The values of risk, calculated within the risk register on the previous page, are summarized as follows:

- **Construction Risks –** Value added to the Raw PSC is $4,144,888.
- **Design Risks -** Value added to the Raw PSC is $499,900.
- **Maintenance costs -** Value added to the Raw PSC is $212,229.
- **Operating the Asset –** Value added to the Raw PSC is $884,284.
- **Asset Management Operations -** Value added to the Raw PSC is $57,619
- **Policy/Regulatory Changes -** Value added to the Raw PSC is $150,000.
- **Revenue from the Asset –** Value added to the Raw PSC is $20,813.
- **The Site –** Value added to the Raw PSC is $1,801,655.

These risks are required to be transferred to a Raw PSC, which once completed, becomes a Risk Adjusted Public Sector Comparator. This process is described in the next section.

## 4.7. The Public Sector Comparator

The Public Sector Comparator (PSC) is a summary of all the assumptions, costs and risks developed throughout the various spreadsheets into one number, i.e. the Net Present Cost. Simplistically, and as discussed in Chapter 2, the PSC is an analysis of:

**Transferable Risk + Competitive Neutrality + Raw PSC + Retained Risk**

It is specifically noted that the author has developed a complete PSC based on the Victorian Partnerships, National Public Private Partnerships Guidelines and a research paper by Lamb et al (2004). All the spreadsheets that appear in this report (unless referenced) and the following sections are a result of the author's creation of Microsoft Excel documents, based on these reference documents. In a few literature cases, the values are expressed as a negative figure, however for the purposes of this report these are identified as a positive number. The development of the PSC includes the following spreadsheets:

- Project Assumptions of Costs
- Risk Register
- Life Cycle Costing Model
- Competitive Neutrality
- Raw PSC
- Risk Adjusted PSC

**Project Assumptions of Costs**

The project assumption costs have been explained in section 4.3 entitled 'Development of a Hypothetical Project'. The values for this will be included into the Raw PSC described further in this chapter.

**Risk Register**

The valuing of risk has already been described in the previous section, however now these values need to be added to a Raw PSC to give a Risk Adjusted Public Sector Comparator. This will be explained further in this chapter under the subheading of Risk Adjusted PSC.

**Life Cycle Costing Model**

The Life Cycle Model is a spreadsheet that attempts to estimate when the Buildings and Siteworks will require maintenance and upgrades over the life of the contract. For Project College, the Life Cycle analysis has been undertaken on a Trade basis for the project. Each item is assessed on its

Potential Life, which identifies how many times it may need to be replaced and the percentage of the item that would need to be replaced. These factors are multiplied to the original cost of the item to show at which point during the project a cost will be borne. The timing for these changes has been sourced from The Australian Institute of Quantity Surveyors, (2002). Australian Cost Management Manual, Volume 3 as well as the author's own construction experience.

For example, based on the literature, the Internal Wall Partitions have an expected life of 10 years. The trade cost of the linings as identified in the Assumptions spreadsheet is $1,294,096. Within this price is also the structure and items that have a life exceeding 10 years, therefore only an assumed 35% of the $1,294,096 will be physically removed and replaced. Items within this 35% would be the plasterboard, plastering and painting portion of the cost.

A percentage of the original cost also needs to be included for demolition and removal of the old items. As sighted by the Australian Institute of Quantity Surveyors, (2002) 5% of the total cost has been included for this removal and disposal work on every item that is required to be replaced.

The full calculation is therefore:

**Trade Cost x % of Capital Replaced x Disposal % = Total Replacement Cost**

**or**

**$1,294,096 x 35% x 5% = $517,639**

This sum ($517,639) is then transferred to each cell under the 'Year' columns in the Life Cycle spreadsheet. A formula then calculates when the cost should be borne based upon the number of replacements, in this

case every 10 years. Therefore, assuming that years 1 and 2 of the project will be the construction phase of the project, year 3 is the first year of operations. Based on the Life Cycle assumptions, after 10 years of operations the linings should be replaced i.e. in year 13. Therefore in the Life Cycle spreadsheet $517,639 appears in the year 13 column and every 10 years after that i.e. again in year 23.

The total cost for the replacement of the linings is calculated by the spreadsheet by totalling the entire row, in this case the total is $1,035,277.

Once each trade item has been assessed by the spreadsheet, the total value of each of the 'year' columns is transferred into the Raw Public Sector Comparator under the subheading of 'Required Through Life Expenditure'.

These figures are then processed by the Raw Public Sector Comparator to include Inflation, Timing and the Discount Rate. These adjustments will be explained further in the next few pages.

The full Life Cycle Costing spreadsheet is on the following page.

It must be noted that this type of analysis can be based on an 'Elemental Cost' basis, but because of the minimal Output specification of this report a Trade based assessment is appropriate.

AUCKLAND COLLEGE

LIFE CYCLE COSTING MODEL

| DESCRIPTION | Construction Cost | LCC Including On Costs | % of Capital Replaced | Total Replacement Cost | Life | No. of Changes During Contract | Total LCC | Year Ended | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Year Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| **Structure** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Site Preparation | 13,371 | 16,312 | 0% | - | 50 | 0 | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Substructure | 1,564,361 | 1,908,520 | 0% | - | 50 | 0 | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frame | 2,157,124 | 2,631,692 | 0% | - | 50 | 0 | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Structural Wall | 659,617 | 804,732 | 0% | - | 50 | 0 | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Upper Floors | 623,902 | 761,233 | 0% | - | 50 | 0 | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Total Structure** | **5,018,434** | **6,122,489** | | | | | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **External Fabric** | | | | | | | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Roof | 2,089,185 | 2,561,086 | 40% | 1,152,453 | 25 | 0 | 1,152,453 | | | | | | | | | | | | | | | | | | | | | | | | | | 1,152,453 |
| External Walls | 2,986,102 | 3,643,044 | 25% | 1,092,913 | 25 | 0 | 1,092,913 | | | | | | | | | | | | | | | | | | | | | | | | | | 1,092,913 |
| Windows and Doors | 1,417,284 | 1,729,087 | 30% | 605,180 | 15 | 1 | 605,180 | | | | | | | | | | | | | | | | 605,180 | | | | | | | | | | |
| **Total External Fabric** | **6,502,571** | **7,933,137** | | | | | **2,850,546** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Internal Finishing** | | | | | | | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stairs | 307,524 | 375,179 | 0% | 18,759 | 25 | 0 | 18,759 | | | | | | | | | | | | | | | | | | | | | | | | | | 18,759 |
| Internal Walls Partitions | 1,069,735 | 1,294,096 | 35% | 517,639 | 15 | 1 | 517,639 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Internal Doors | 534,824 | 652,486 | 75% | 521,988 | 10 | 2 | 1,043,977 | | | | | | | | | | | 521,988 | | | | | | | | | | 521,988 | | | | | |
| Floor Finishes | 1,412,827 | 1,723,649 | 50% | 948,007 | 10 | 2 | 1,896,014 | | | | | | | | | | | 948,007 | | | | | | | | | | 948,007 | | | | | |
| Wall Finishes | 1,386,086 | 1,691,025 | 50% | 930,064 | 5 | 5 | 4,650,319 | | | | | | 930,064 | | | | | 930,064 | | | | | 930,064 | | | | | 930,064 | | | | | 930,064 |
| Ceiling Finishes | 1,051,821 | 1,283,222 | 50% | 705,772 | 15 | 1 | 705,772 | | | | | | | | | | | | | | | | 705,772 | | | | | | | | | | |
| Fitting and Fixtures | 1,305,339 | 1,946,582 | 75% | 1,557,266 | 20 | 1 | 1,557,266 | | | | | | | | | | | | | | | | | | | | | 1,557,266 | | | | | |
| **Total Internal Finishing** | **7,349,376** | **8,966,239** | | | | | **10,907,383** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Services** | | | | | | | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sanitary plumbing | 601,677 | 734,046 | 30% | 220,214 | 20 | 1 | 220,214 | | | | | | | | | | | | | | | | | | | | | 220,214 | | | | | |
| Mechanical Services | 1,065,192 | 1,299,534 | 30% | 389,860 | 25 | 0 | 389,860 | | | | | | | | | | | | | | | | | | | | | | | | | | 389,860 |
| Fire Services | 1,042,907 | 1,272,347 | 25% | 318,087 | 25 | 0 | 318,087 | | | | | | | | | | | | | | | | | | | | | | | | | | 318,087 |
| Electrical Services | 2,125,926 | 2,593,630 | 50% | 1,296,815 | 15 | 1 | 1,296,815 | | | | | | | | | | | | | | | | 1,296,815 | | | | | | | | | | |
| Lifts and Escalators | 208,301 | 254,469 | 75% | 190,852 | 25 | 0 | 190,852 | | | | | | | | | | | | | | | | | | | | | | | | | | 190,852 |
| Special Services | 120,335 | 146,809 | 50% | 73,405 | 10 | 2 | 146,809 | | | | | | | | | | | 73,405 | | | | | | | | | | 73,405 | | | | | |
| Drainage | 142,620 | 173,996 | 25% | 43,499 | 25 | 0 | 43,499 | | | | | | | | | | | | | | | | | | | | | | | | | | 43,499 |
| **Total Services** | **5,307,229** | **6,474,832** | | | | | **2,806,136** | | | | | | **930,064** | | | | | **2,991,103** | | | | | **3,537,031** | | | | | **4,768,502** | | | | | **4,136,487** |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TOTAL CONSTRUCTION | $ 24,177,620 | $ 29,496,687 | | | | | $ 16,364,066 | | | | | | | | | | | | | | | | | | | | | | | | | | |

INSERT TABLE 16 A3 COPY OF THIS SPREADSHEET

## Competitive Neutrality

Predominately, the adjustment for competitive neutrality consists of removing any advantage the Government has. Grimsey et al., (2005, page 357) has identified "land, Local Government, payroll and capital transaction taxes", Partnership Victoria (2001, page 25) includes "public scrutiny and reporting requirements faced by a private enterprise". In simple terms, if competitive neutrality is not undertaken, the PSC may be artificially lower then a potential consortium bid.

## The Raw Public Sector Comparator

Each of the above spreadsheets, i.e. Project Assumptions, Value of Risk and Life Cycle Cost and the like are entered into a separate copy of the Raw Public Sector Comparator. This is a complex process and requires the inclusion of the base cost, inflation rates and the timing of when the costs are to be borne. Figure 7 below shows how construction costs are inputted into the Raw PSC.

**PUBLIC SECTOR COMPARATOR COST CALCULATIONS**

The Construction Cost is added to this cell and multiplied by the Rate of Inflation and the % of how much of the cost is borne during this period

| Capital Costs | Net Present Cost | Nominal Cost | | | | |
|---|---|---|---|---|---|---|
| **Direct Costs** | | | | | | |
| Land Acquisition and Development | 5,000,000 | 5,000,000 | 5,000,000 | - | - | - |
| Site Works | 7,431,223 | 7,647,651 | 1,876,724 | 5,770,927 | - | - |
| Construction Price | 26,471,643 | 27,242,609 | 6,685,303 | 20,557,306 | - | - |
| Consultant Costs | 2,155,328 | 2,282,058 | 445,225 | 1,369,068 | 467,765 | - |
| Plant and Equipment Acquisitions | 3,328,019 | 3,523,702 | 171,241 | 2,632,823 | 719,638 | - |
| Required Through-life Capital Expenditure | 12,294,702 | 25,487,671 | - | - | - | - |
| **Indirect Costs** | | | | | | |
| Construction Overheads | 526,185 | 541,510 | 267,412 | 274,097 | - | - |
| **Total Direct Capital Costs** | **57,207,100** | **71,725,202** | **14,445,905** | **30,604,222** | **1,187,403** | **-** |

This is the Nominal Cost multiplied by the Discount Rate to show the Net Present Cost

This is the sum of Years 1 and 2 costs

The Construction Cost is added to this cell and multiplied by the Rate of Inflation and the % of how much of the cost is borne during this period

**Figure 7:** Construction Cost Input into the Raw PSC

Basically, each cost included in the PSC is sourced from a corresponding spreadsheet and entered into the year columns on the PSC and multiplied by the rate of inflation and the percentage of the cost that will be realised during that period.

To determine the Net Present Cost of Construction, the construction budget of $26,741,211, is multiplied by a factor of inflation, in this case 1 because the cost would technically not attract inflation in the first year. In subsequent years, the inflation rate is 1 plus the inflation rate, i.e. year 2 equals 1 + 2.5% = 1.025 and year 3 equals 1.025 + 2.5% = 1.051 and so on.

Once inflation is added to the construction cost, this must be multiplied by the percentage that the cost will be expended during that year. For construction, it was identified that the programme would start on the 10th January 2011 and design and construction would take 24 months. It was assumed that construction would start sometime towards the end of 2011 but the majority of the design cost would be expended before construction started. In this case it was assessed that 25% of the construction would be expended in the first year (2011), with the remaining 75% in the second year (2012). Construction would be complete by the 31st December 2012. The full calculation is:

**Assumed Cost x Inflation Factor x Timing = Nominal Cost Year 1**

**26,741,211 x 1.000 x 25% = 6,685,303**

The second year nominal cost equals:

**Assumed Cost x Inflation Factor x Timing = Nominal Cost Year 2**

**26,741,211 x 1.025 x 75% = 20,577,306**

The total Nominal Cost then equals the sum of all the years' i.e.

**Nominal Cost Year 1 + Nominal Cost Year 2 = Total Nominal Cost**

**20,577,306 + 6,685,303 = 27,242,609**

The construction cost noted above is only expended over two years, where as an operating cost would be included in each year from the time the school was opened for students, therefore the values will only appear in PSC for the year when the cost is expended.

The Net Present Cost is a calculation of the Nominal Cost multiplied by the Discount Rate for the total period the cost is being expended, in this case as identified in Table 17 on the next page, the calculation is:

**27,242,609 x 0.94340 = 26,471,643**

This figure is therefore the cost of construction, including an adjustment for inflation for a portion of the cost in the second year, less the discount adjustment. It must be noted that the Net Present Cost is completely reliant upon the calculation of the Discount Rate over time, which for this report, was taken from The Australian Institute of Quantity Surveyors, (2002). Australian Cost Management Manual, Volume 3.

Each cost as identified in the assumptions, is entered in the same manner as the Construction costs explained above. This initial process can be very time consuming but when it is completed, any potential changes in assumptions will automatically be changed in the spreadsheet and corresponding Net Present Cost calculation. The sum of all of the construction and operating cost calculations is a Raw Net Present Cost for Project College of $124,997,839. The full Raw PSC in included on the following page in Table 17.

PROJECT COLLEGE

RAW PUBLIC SECTOR COMPARATOR

| | | | Year Ended | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Year Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| **Cashflow** | **Net Present Cost** | **Nominal Cost** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Construction Costs | $ 57,207,100 | $ 71,725,202 | | 14,445,905 | 30,604,222 | 1,187,493 | - | - | 1,052,202 | - | - | - | - | 3,828,864 | - | - | - | - | 5,123,834 | - | - | - | - | 7,813,877 | - | - | - | - | 7,668,815 | - |
| Total Operating and Maintenance Cost | $ 67,790,739 | $ 140,534,358 | | - | - | 4,114,273 | 4,217,130 | 4,322,558 | 4,430,622 | 4,541,387 | 4,654,922 | 4,771,295 | 4,890,577 | 5,012,842 | 5,138,163 | 5,266,617 | 5,398,282 | 5,533,239 | 5,671,570 | 5,813,360 | 5,958,694 | 6,107,661 | 6,260,353 | 6,416,861 | 6,577,283 | 6,741,715 | 6,910,258 | 7,083,014 | 7,260,090 | 7,441,592 |
| **Raw PSC** | **$ 124,997,839** | **$ 212,259,559** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**DISCOUNT FACTOR**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Discount Factors | 1.00000 | 0.94340 | 0.89000 | 0.83962 | 0.79209 | 0.74726 | 0.70496 | 0.66506 | 0.62741 | 0.59190 | 0.55839 | 0.52672 | 0.49697 | 0.46884 | 0.44230 | 0.41727 | 0.39365 | 0.37136 | 0.35034 | 0.33051 | 0.31180 | 0.29414 | 0.27747 | 0.26169 | 0.24676 | 0.23300 | 0.21955 | | |

**EXPENDITURE TIMING (%)**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Direct Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Acquisition and Development | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Site Works | 25% | 75% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Construction Price | 25% | 75% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Consultant Costs | 20% | 60% | 20% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Plant and Equipment Acquisitions | 5% | 75% | 20% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Required Through-life Capital Expenditure | 0% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Indirect Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Overheads | 100% | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Administrative overheads | 0% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Operating Period** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Operating and Third Party Revenue | 0% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

**INFLATION FACTORS**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inflation Factors - Capital Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Direct Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Acquisition and Development | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 | | |
| Project Design | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 | | |
| Site Works | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 | | |
| Construction Price | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 | | |
| Consultant Costs | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 | | |
| Plant and Equipment Acquisitions | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 | | |
| Required through-life capital expenditure | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 | | |
| **Indirect Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Overheads | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 | | |

**COST CALCULATIONS**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Costs** | **Net Present Cost** | **Nominal Cost** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Direct Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Acquisition and Development | 5,000,000 | 5,000,000 | 5,000,000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Site Works | 7,431,223 | 7,647,651 | 1,876,724 | 5,770,927 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Construction Price | 26,471,643 | 27,242,609 | 6,685,303 | 20,557,306 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Consultant Costs | 2,155,328 | 2,282,058 | 445,225 | 1,369,068 | 467,765 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Plant and Equipment Acquisitions | 3,328,019 | 3,523,702 | 171,241 | 2,632,823 | 719,638 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Required Through-life Capital Expenditure | 12,294,702 | 25,487,671 | - | - | - | - | - | 1,052,202 | - | - | - | 3,828,864 | - | - | - | - | 5,123,834 | - | - | - | 7,813,877 | - | - | - | 7,668,815 | - | | | |
| **Indirect Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Overheads | 526,185 | 541,510 | 267,412 | 274,097 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Total Direct Capital Costs** | **57,207,100** | **71,725,202** | **14,445,905** | **30,604,222** | **1,187,403** | - | - | **1,052,202** | - | - | - | **3,828,864** | - | - | - | - | **5,123,834** | - | - | - | **7,813,877** | - | - | - | **7,668,815** | - | | | |

Following the inclusion of the assumed costs into the Raw Public Sector Comparator, the next and most crucial part is to add the valued risk into the spreadsheet so that a Risk Adjusted Public Sector Comparator can be developed and the true Net Present Cost of Project College determined.

## The Risk Adjusted Public Sector Comparator

The Risk Adjusted Public Sector Comparator (Risk Adjusted PSC) takes the Raw PSC and simply adds a summary of the Competitive Neutrality and values of Risk. The sums for Competitive Neutrality included in the Risk Adjusted PSC have already been adjusted for Inflation and Timing etc., so the formula in the cell is summing a calculation that has already taken place on the separate Competitive Neutrality spreadsheet. For the risk values however, these need to go though the same process of calculation as the Assumptions, Value of Risk and Life Cycle Costs, where they are adjusted for Inflation, Timing and the Discount Rate.

Once all of these costs are included in the spreadsheet, the Net Present Costs is summarised as follows:

**Table 18:** Net Present Cost Summary Calculation.

| | | **Net Present Cost** |
|---|---|---|
| Raw PSC | $ | 124,997,839 |
| Competitive Neutrality | $ | 4,874,037 |
| Transferred Risk | $ | 7,669,526 |
| Retained Risk | $ | 5,906,924 |
| **PSC NET PRESENT COST** | **$** | **143,448,326** |

The full Risk Adjusted PSC is included on the following page.

**PROJECT COLLEGE**

**RISK ADJUSTED RAW PUBLIC SECTOR COMPARATOR**

| Year Ended | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |

**DISCOUNT FACTOR**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Discount Factor | 1.00000 | 0.94340 | 0.89000 | 0.83962 | 0.79209 | 0.74726 | 0.70496 | 0.66506 | 0.62741 | 0.59190 | 0.55839 | 0.52672 | 0.49697 | 0.46884 | 0.44230 | 0.41727 | 0.39365 | 0.37136 | 0.35034 | 0.33051 | 0.31180 | 0.29414 | 0.27747 | 0.26169 | 0.24676 | 0.23300 | 0.21991 |

**EXPENDITURE TIMING (%)**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Direct Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Acquisition and Development | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Site Works | 25% | 75% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Construction Price | 25% | 75% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Consultant Costs | 20% | 60% | 20% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Plant and Equipment Acquisitions | 5% | 75% | 20% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Required Through-life Capital Expenditure | 0% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Indirect Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Overheads | 100% | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Administrative overheads | 0% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Operating Period** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Operating and Third Party Revenue | 0% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

**INFLATION FACTORS**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inflation Factors - Capital Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Direct Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Acquisition and Development | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Project Design | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Site Works | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Construction Price | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Consultant Costs | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Plant and Equipment Acquisitions | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Required Through-life Capital Expenditure | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| **Indirect Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Overheads | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| **Inflation Factors - Operations and Construction** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Maintenance Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maintenance Costs | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| **Direct Operating Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| School Executive Costs | 1 | 1.040 | 1.066 | 1.093 | 1.120 | 1.148 | 1.177 | 1.206 | 1.236 | 1.267 | 1.299 | 1.331 | 1.365 | 1.399 | 1.434 | 1.469 | 1.506 | 1.544 | 1.582 | 1.622 | 1.663 | 1.704 | 1.747 | 1.790 | 1.835 | 1.881 | 1.928 |
| Teaching Staff Costs | 1 | 1.040 | 1.066 | 1.093 | 1.120 | 1.148 | 1.177 | 1.206 | 1.236 | 1.267 | 1.299 | 1.331 | 1.365 | 1.399 | 1.434 | 1.469 | 1.506 | 1.544 | 1.582 | 1.622 | 1.663 | 1.704 | 1.747 | 1.790 | 1.835 | 1.881 | 1.928 |
| Other Staff Costs | 1 | 1.040 | 1.066 | 1.093 | 1.120 | 1.148 | 1.177 | 1.206 | 1.236 | 1.267 | 1.299 | 1.331 | 1.365 | 1.399 | 1.434 | 1.469 | 1.506 | 1.544 | 1.582 | 1.622 | 1.663 | 1.704 | 1.747 | 1.790 | 1.835 | 1.881 | 1.928 |
| Electricity | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Water | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Telecommunications | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Facilities Management | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Local Government Costs/Rates | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Insurances | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| **Indirect Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Operating Overheads | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| Administrative overheads | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |
| **Third Party Revenue** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Third Party Revenue | 1 | 1.025 | 1.051 | 1.077 | 1.104 | 1.131 | 1.160 | 1.189 | 1.218 | 1.249 | 1.280 | 1.312 | 1.345 | 1.379 | 1.413 | 1.448 | 1.485 | 1.522 | 1.560 | 1.599 | 1.639 | 1.680 | 1.722 | 1.765 | 1.809 | 1.854 | 1.900 |

**COST CALCULATIONS**

| **Capital Costs** | **Net Present Cost** | **Nominal Cost** | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Direct Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Acquisition and Development | 5,000,000 | 5,000,000 | 5,000,000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Site Works | 7,431,223 | 7,647,651 | 1,876,724 | 5,770,927 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Construction Price | 26,471,643 | 27,242,609 | 6,685,303 | 20,557,306 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Consultant Costs | 2,155,328 | 2,282,058 | 445,225 | 1,369,868 | 467,765 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Plant and Equipment Acquisitions | 3,328,019 | 3,523,702 | 173,241 | 2,632,823 | 719,638 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Required Through-life Capital Expenditure | 12,294,702 | 25,487,671 | - | - | - | - | 1,052,282 | - | - | - | - | 3,828,864 | - | - | - | - | 5,123,834 | - | - | - | - | 7,813,877 | - | - | - | - | 7,668,815 | - |
| **Indirect Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Overheads | 526,185 | 541,510 | 267,412 | 274,097 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Total Direct Capital Costs** | **57,207,100** | **71,725,202** | **14,445,905** | **30,604,222** | **1,187,403** | **-** | **-** | **1,052,282** | **-** | **-** | **-** | **-** | **3,828,864** | **-** | **-** | **-** | **-** | **5,123,834** | **-** | **-** | **-** | **-** | **7,813,877** | **-** | **-** | **-** | **-** | **7,668,815** | **-** |
| **Operations and Construction Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Maintenance Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maintenance Costs | 7,816,865 | 16,204,841 | - | - | 474,412 | 486,272 | 498,429 | 510,889 | 523,662 | 536,753 | 550,172 | 563,926 | 578,025 | 592,475 | 607,287 | 622,469 | 638,031 | 653,982 | 670,331 | 687,090 | 704,267 | 721,873 | 739,920 | 758,418 | 777,379 | 796,813 | 816,734 | 837,152 | 858,081 |
| **Direct Operating Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| School Executive Costs | 9,295,685 | 19,270,525 | - | - | 564,162 | 578,266 | 592,723 | 607,541 | 622,730 | 638,298 | 654,255 | 670,612 | 687,377 | 704,562 | 722,176 | 740,230 | 758,736 | 777,704 | 797,147 | 817,075 | 837,502 | 858,440 | 879,901 | 901,898 | 924,446 | 947,557 | 971,246 | 995,527 | 1,020,415 |
| Teaching Staff Costs | 42,100,650 | 87,277,228 | - | - | 2,555,121 | 2,618,999 | 2,684,474 | 2,751,586 | 2,820,376 | 2,890,885 | 2,963,157 | 3,037,236 | 3,113,167 | 3,190,996 | 3,270,771 | 3,352,540 | 3,436,354 | 3,522,263 | 3,610,319 | 3,700,577 | 3,793,092 | 3,887,919 | 3,985,117 | 4,084,745 | 4,186,864 | 4,291,535 | 4,398,824 | 4,508,794 | 4,621,514 |
| Other Staff Costs | 4,074,952 | 8,447,625 | - | - | 247,312 | 253,495 | 259,832 | 266,328 | 272,986 | 279,811 | 286,806 | 293,976 | 301,326 | 308,859 | 316,580 | 324,495 | 332,607 | 340,922 | 349,445 | 358,182 | 367,136 | 376,314 | 385,722 | 395,365 | 405,250 | 415,381 | 425,765 | 436,409 | 447,320 |
| Electricity | 1,718,041 | 3,561,605 | - | - | 104,280 | 106,876 | 109,548 | 112,287 | 115,094 | 117,971 | 120,920 | 123,943 | 127,042 | 130,218 | 133,473 | 136,810 | 140,231 | 143,736 | 147,330 | 151,013 | 154,788 | 158,658 | 162,624 | 166,690 | 170,857 | 175,129 | 179,507 | 183,995 | 188,595 |
| Water | 1,386,329 | 2,873,946 | - | - | 84,137 | 86,241 | 88,397 | 90,607 | 92,872 | 95,194 | 97,574 | 100,013 | 102,513 | 105,076 | 107,703 | 110,396 | 113,155 | 115,984 | 118,884 | 121,856 | 124,902 | 128,025 | 131,226 | 134,506 | 137,869 | 141,316 | 144,849 | 148,470 | 152,182 |
| Telecommunications | 207,733 | 430,644 | - | - | 12,608 | 12,923 | 13,246 | 13,577 | 13,916 | 14,264 | 14,621 | 14,986 | 15,361 | 15,745 | 16,139 | 16,542 | 16,956 | 17,380 | 17,814 | 18,259 | 18,716 | 19,184 | 19,663 | 20,155 | 20,659 | 21,175 | 21,705 | 22,247 | 22,804 |
| Facilities Management | 4,152,847 | 8,609,107 | - | - | 252,040 | 258,341 | 264,799 | 271,419 | 278,204 | 285,160 | 292,289 | 299,596 | 307,086 | 314,763 | 322,632 | 330,698 | 338,965 | 347,439 | 356,125 | 365,028 | 374,154 | 383,508 | 393,096 | 402,923 | 412,996 | 423,321 | 433,904 | 444,752 | 455,870 |
| Insurances | 207,733 | 430,644 | - | - | 12,608 | 12,923 | 13,246 | 13,577 | 13,916 | 14,264 | 14,621 | 14,986 | 15,361 | 15,745 | 16,139 | 16,542 | 16,956 | 17,380 | 17,814 | 18,259 | 18,716 | 19,184 | 19,663 | 20,155 | 20,659 | 21,175 | 21,705 | 22,247 | 22,804 |
| **Indirect Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Operating Overheads | 259,667 | 538,385 | - | - | 15,759 | 16,153 | 16,557 | 16,971 | 17,395 | 17,830 | 18,276 | 18,733 | 19,201 | 19,681 | 20,173 | 20,678 | 21,195 | 21,724 | 22,268 | 22,824 | 23,395 | 23,980 | 24,579 | 25,194 | 25,824 | 26,469 | 27,131 | 27,809 | 28,504 |
| Administrative overheads | 173,111 | 358,870 | - | - | 10,506 | 10,769 | 11,038 | 11,314 | 11,597 | 11,887 | 12,184 | 12,489 | 12,801 | 13,121 | 13,449 | 13,785 | 14,130 | 14,483 | 14,845 | 15,216 | 15,597 | 15,987 | 16,386 | 16,796 | 17,216 | 17,646 | 18,087 | 18,539 | 19,003 |
| **Third Party Revenue** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Less*** Third Party Revenue | (3,602,876) | (7,468,982) | - | - | (218,661) | (224,128) | (229,731) | (235,474) | (241,361) | (247,395) | (253,580) | (259,920) | (266,418) | (273,078) | (279,905) | (286,903) | (294,075) | (301,427) | (308,963) | (316,687) | (324,604) | (332,719) | (341,037) | (349,563) | (358,302) | (367,260) | (376,441) | (385,852) | (395,498) |
| **Total Operations and Construction Costs** | **67,790,739** | **140,534,358** | **-** | **-** | **4,114,273** | **4,217,130** | **4,322,558** | **4,430,622** | **4,541,387** | **4,654,922** | **4,771,295** | **4,890,577** | **5,012,842** | **5,138,163** | **5,266,617** | **5,398,282** | **5,533,239** | **5,671,570** | **5,813,360** | **5,958,694** | **6,107,661** | **6,260,353** | **6,416,861** | **6,577,283** | **6,741,715** | **6,910,258** | **7,083,014** | **7,260,090** | **7,441,592** |
| **TOTAL RAW PSC** | **124,997,839** | **212,259,559** | **14,445,905** | **30,604,222** | **5,301,676** | **4,217,130** | **4,322,558** | **5,482,904** | **4,541,387** | **4,654,922** | **4,771,295** | **4,890,577** | **8,841,706** | **5,138,163** | **5,266,617** | **5,398,282** | **5,533,239** | **10,795,405** | **5,813,360** | **5,958,694** | **6,107,661** | **6,260,353** | **14,230,738** | **6,577,283** | **6,741,715** | **6,910,258** | **7,083,014** | **14,928,904** | **7,441,592** |

**COMPETITIVE NEUTRALITY**

| | **Net Present Cost** | **Nominal Cost** | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Tax | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Payroll Tax (Staffing) | 2,881,748 | 5,974,040 | - | - | 440,890 | 415,933 | 392,387 | 370,179 | 349,225 | 329,459 | 310,808 | 293,217 | 276,616 | 260,928 | 246,090 | 232,255 | 219,107 | 206,708 | 195,007 | 183,965 | 173,552 | 163,729 | 154,460 | 145,712 | 137,454 | 129,637 | 122,240 | 115,424 | 108,959 |
| Local Government Rates | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Corporate Overheads | 1,992,289 | 4,130,137 | - | - | 304,808 | 287,554 | 271,276 | 255,922 | 241,435 | 227,770 | 214,876 | 202,715 | 191,238 | 180,392 | 170,203 | 160,569 | 151,479 | 142,907 | 134,818 | 127,184 | 119,985 | 113,193 | 106,786 | 100,737 | 95,028 | 89,624 | 84,511 | 79,798 | 75,329 |
| **Total Competitive Neutrality** | **4,874,037** | **10,104,177** | **-** | **-** | **745,698** | **703,487** | **663,663** | **626,102** | **590,660** | **557,229** | **525,684** | **495,931** | **467,854** | **441,319** | **416,293** | **392,824** | **370,587** | **349,615** | **329,825** | **311,149** | **293,537** | **276,922** | **261,246** | **246,449** | **232,482** | **219,260** | **206,751** | **195,222** | **184,288** |

**TOTAL NON RISK ADJUSTED PSC**

| | **Net Present Cost** | **Nominal Cost** |
|---|---|---|
| Raw PSC | 124,997,839 | 212,259,559 |
| Competitive Neutrality | 4,874,037 | 10,104,177 |
| **Total Non Risk Adjusted PSC** | **129,871,876** | **222,363,737** |

**RISK ADJUSTMENTS**

| **Transferable Risk** | **Net Present Cost** | **Nominal Cost** | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Construction Risk | 3,856,616 | 3,968,937 | 1,036,222 | 2,932,715 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Design Risk | 445,718 | 471,926 | 99,980 | 282,964 | 88,982 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Maintenance | 1,234,586 | 2,559,371 | - | - | 188,884 | 178,192 | 168,105 | 158,591 | 149,613 | 141,145 | 133,155 | 125,619 | 118,507 | 111,785 | 105,472 | 99,502 | 93,869 | 88,557 | 83,544 | 78,813 | 74,352 | 70,144 | 66,173 | 62,425 | 58,887 | 55,538 | 52,370 | 49,449 | 46,680 |
| Operating the Asset - Asset Management | 335,183 | 694,854 | - | - | 51,281 | 48,378 | 45,639 | 43,056 | 40,619 | 38,320 | 36,151 | 34,105 | 32,174 | 30,349 | 28,635 | 27,014 | 25,485 | 24,043 | 22,682 | 21,397 | 20,186 | 19,044 | 17,966 | 16,948 | 15,988 | 15,078 | 14,218 | 13,425 | 12,673 |
| Revenue for the Asset | 121,071 | 250,988 | - | - | 18,523 | 17,475 | 16,485 | 15,552 | 14,672 | 13,842 | 13,058 | 12,319 | 11,621 | 10,962 | 10,343 | 9,758 | 9,205 | 8,684 | 8,193 | 7,729 | 7,291 | 6,879 | 6,489 | 6,122 | 5,775 | 5,446 | 5,136 | 4,849 | 4,578 |
| The Site | 1,676,353 | 1,725,175 | 450,414 | 1,274,761 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Total Transferable Risk** | **7,669,526** | **9,671,251** | **1,586,616** | **4,490,440** | **347,670** | **244,045** | **230,230** | **217,199** | **204,904** | **193,307** | **182,364** | **172,042** | **162,302** | **153,097** | **144,450** | **136,273** | **128,559** | **121,284** | **114,419** | **107,940** | **101,830** | **96,066** | **90,628** | **85,495** | **80,650** | **76,063** | **71,723** | **67,724** | **63,931** |
| **Retained Risk** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Policy/Regulatory Changes | 856,669 | 1,775,927 | - | - | 133,500 | 125,943 | 118,814 | 112,089 | 105,744 | 99,759 | 94,112 | 88,785 | 83,759 | 79,008 | 74,546 | 70,326 | 66,345 | 62,591 | 59,048 | 55,704 | 52,551 | 49,577 | 46,770 | 44,121 | 41,621 | 39,254 | 37,014 | 34,950 | 32,993 |
| Operating the Asset - Staffing | 5,050,256 | 10,469,490 | - | - | 787,013 | 742,463 | 700,433 | 660,790 | 623,385 | 588,102 | 554,809 | 523,408 | 493,775 | 465,770 | 439,463 | 414,588 | 391,119 | 368,985 | 348,098 | 328,388 | 309,800 | 292,265 | 275,720 | 260,103 | 245,362 | 231,408 | 218,206 | 206,038 | 194,466 |
| **Total Retained Risk** | **5,906,924** | **12,245,416** | **-** | **-** | **920,513** | **868,406** | **819,246** | **772,879** | **729,129** | **687,861** | **648,920** | **612,193** | **577,534** | **544,778** | **514,008** | **484,914** | **457,464** | **431,576** | **407,146** | **384,092** | **362,351** | **341,841** | **322,490** | **304,224** | **286,983** | **270,662** | **255,220** | **240,988** | **227,491** |
| **TOTAL RISK ADJUSTMENTS** | **13,576,450** | **21,916,667** | | | | | | | | | | | | | | | | | | | | | | | | | |

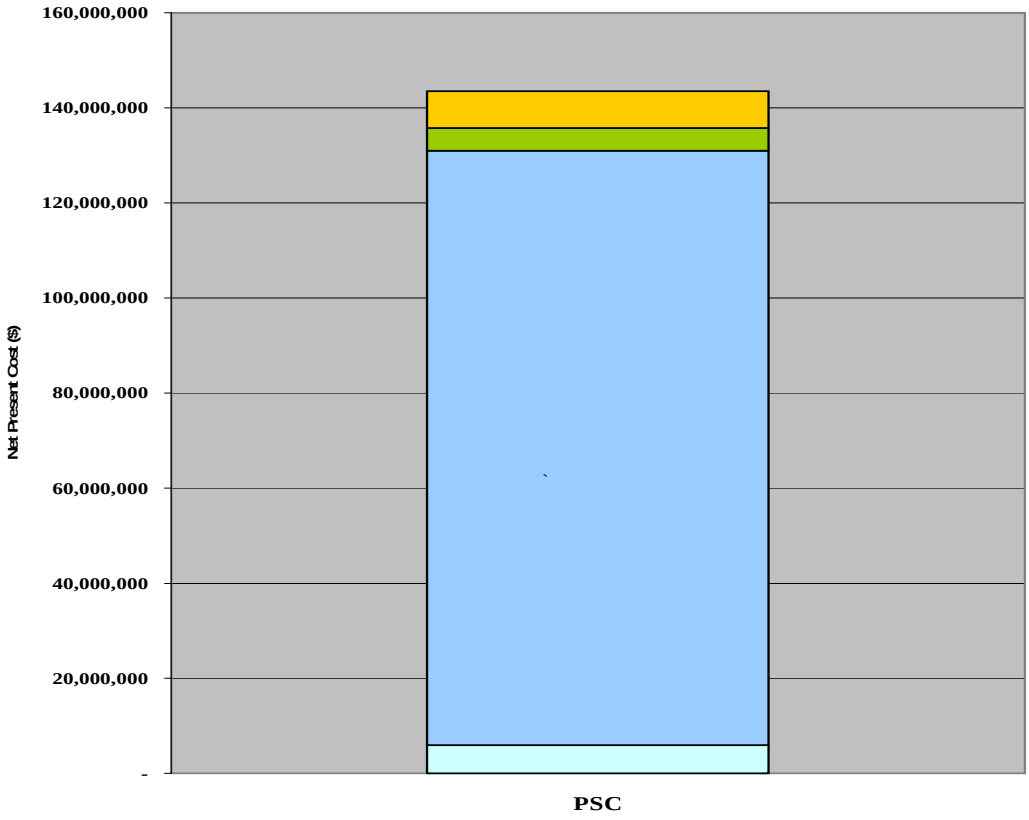
**PUBLIC SECTOR COMPARATOR NET PRESENT COST**

| | **Net Present Cost** | **Nominal Cost** |
|---|---|---|
| Raw PSC | 124,997,839 | 212,259,559 |
| Competitive Neutrality | 4,874,037 | 10,104,177 |
| Risk Adjustments | 13,576,450 | 21,916,667 |
| **PSC NET PRESENT COST** | **143,448,326** | |

Table 19. Risk Adjusted Public Sector Comparator

As defined in Table 18, the Risk Adjusted PSC has identified totals for the Raw PSC, Competitive Neutrality, Transferred Risk and Retained Risks. The following graphical representation, based on similar graphs from Morallos et al., (2008), Partnership Victoria (2001) and Cartlidge (2006) has been used to illustrate components of the Risk Adjusted PSC.

**Table 20:** Public Sector Comparator




| | | | |
|---|---|---|---|
| Transferred Risk | $ | 7,669,526 | 5% |
| Competitive Neutrality | $ | 4,874,037 | 3% |
| Raw PSC | $ | 124,997,839 | 87% |
| Retained Risk | $ | 5,906,924 | 4% |
| **TOTAL PSC** | **$** | **143,448,326** | **100%** |

The Net Present Cost of Project College is therefore $143,448,326.

## 4.8. Sensitive Analysis of the Public Sector Comparator

Following the development of the PSC, the first analysis undertaken has been a simple sensitivity analysis of the Net Present Cost (NPC). As outlined in the previous section, the PSC is a combination of the Transferable Risk, Competitive Neutrality, the Raw PSC and Retained Risk. Apart from the Competitive Neutrality, each of the above has elements of Direct and Indirect costs, Operation, Revenue and Capital Purchases. The cost components/risks that make up this sensitivity analysis are the same as the identified risk, which are Construction, Design, Maintenance, Operations – Asset Management and Staffing, Policy Changes, Revenue from the Asset and the Site.

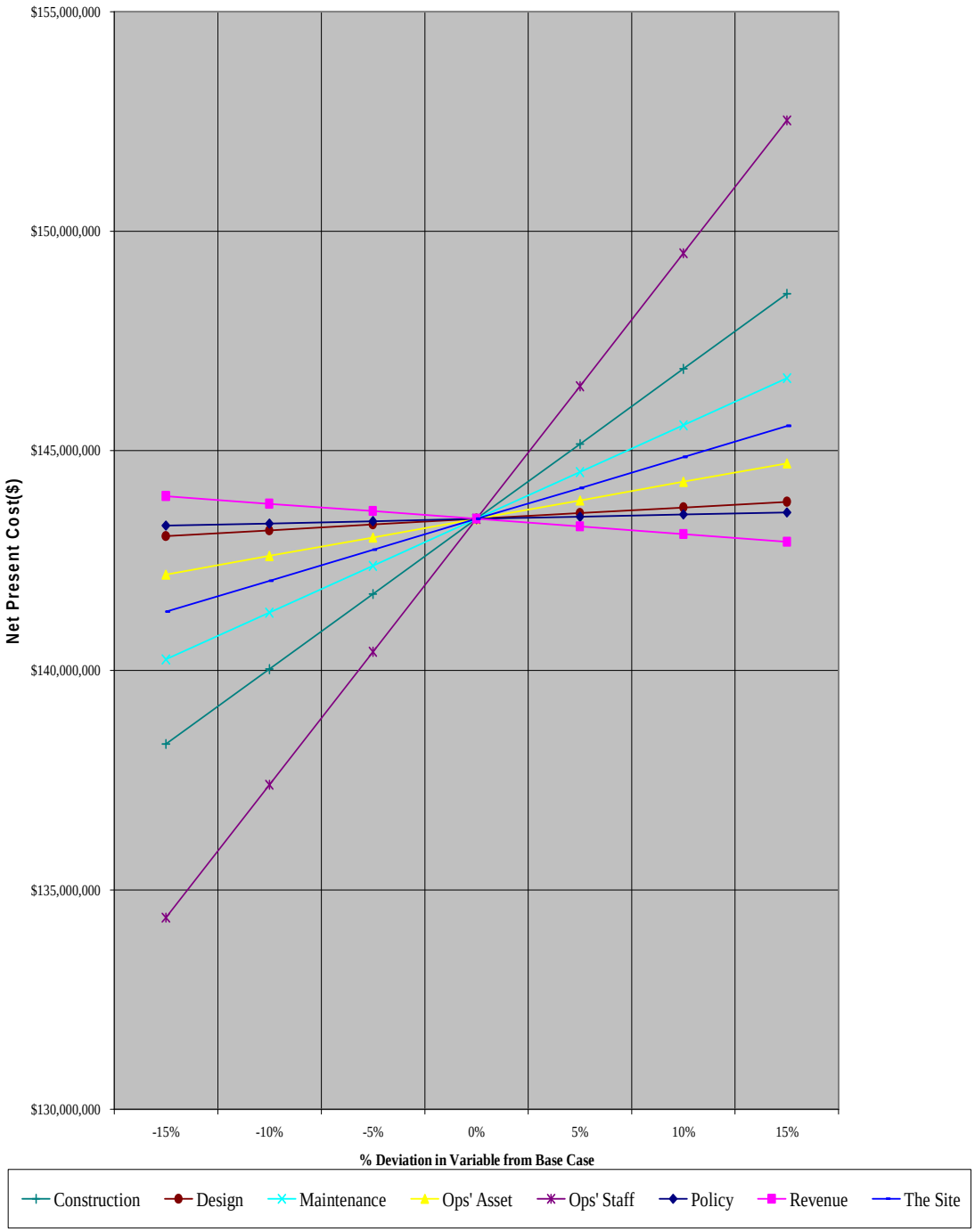
The NPC, i.e. $143,448,326, is entered into a spreadsheet where the values of subtotals of the Risk Adjusted PSC are deviated by 5% between -15% and +15%. The NPC of Construction, for example, is analysed by taking the total NPC of risk and deviated by the above percentages. This is illustrated in Table 21 below.

**Table 21:** Construction Sensitivity Analysis Example

| | **Adjustment** | | **PSC** | | Sensitivity |
|---|---|---|---|---|---|
| | -15% | $ | 138,320,956 | -$ | 5,127,369 |
| | -10% | $ | 140,030,079 | -$ | 3,418,246 |
| | -5% | $ | 141,739,203 | -$ | 1,709,123 |
| **Construction** | **0%** | **$** | **143,448,326** | $ | 34,182,463 |
| | 5% | $ | 145,157,449 | $ | 1,709,123 |
| | 10% | $ | 146,866,572 | $ | 3,418,246 |
| | 15% | $ | 148,575,695 | $ | 5,127,369 |

This assessment is very simple but shows how potential revaluing of items can affect the PSC. Table 22 on the following page is a summary of this assessment and a sensitivity analysis graph illustrating the corresponding values.

**Table 22:** Sensitivity Analysis of Base Risk




| % Change | Construction | Design | Maintenance | Ops' Asset | Ops' Staff | Policy | Revenue | Site |
|---|---|---|---|---|---|---|---|---|
| -15% | $ 138,320,956 | $ 143,058,169 | $ 140,246,403 | $ 142,182,229 | $ 134,370,094 | $ 143,297,326 | $ 143,970,596 | $ 141,332,189 |
| -10% | $ 140,030,079 | $ 143,188,221 | $ 141,313,711 | $ 142,604,261 | $ 137,396,172 | $ 143,347,659 | $ 143,796,506 | $ 142,037,568 |
| -5% | $ 141,739,203 | $ 143,318,273 | $ 142,381,018 | $ 143,026,294 | $ 140,422,249 | $ 143,397,992 | $ 143,622,416 | $ 142,742,947 |
| **0%** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** |
| 5% | $ 145,157,449 | $ 143,578,378 | $ 144,515,633 | $ 143,870,358 | $ 146,474,403 | $ 143,498,659 | $ 143,274,236 | $ 144,153,705 |
| 10% | $ 146,866,572 | $ 143,708,430 | $ 145,582,941 | $ 144,292,390 | $ 149,500,480 | $ 143,548,993 | $ 143,100,145 | $ 144,859,083 |
| 15% | $ 148,575,695 | $ 143,838,483 | $ 146,650,249 | $ 144,714,423 | $ 152,526,557 | $ 143,599,326 | $ 142,926,055 | $ 145,564,462 |

As highlighted previously, the author has developed all of the spreadsheets based upon the Victorian Partnership (2001) and Australian National PPP Guidelines (2008).

## 4.9. Sensitivity Analysis of the Impact of Risk

As noted previously, the sensitivity analysis is very simple and assumes that the assumptions on risk made within the PSC are accurate. National PPP Guidelines have produced a similar analysis and have noted that the "steeper the gradient of the line, the more sensitive is the total PSC to changes in the particular variable" (page 105). In this instance Operations – Staff are the most perceptible to change. The author has undertaken a secondary specific sensitivity analysis on the 'value of risk' included in the PSC. Each base value of risk was adjusted by a deviation of 5% between -15% and +15%. It is postulated that by revaluing each individual impact, a more accurate assessment of the sensitivity to change could be demonstrated.

**Table 23:** Deviation of the Impact of Risk

| RETAINED RISK | -15% | -10% | -5% | BASE | 5% | 10% | 15% |
|---|---|---|---|---|---|---|---|
| Policy/ Regulatory | 90,000 | 110,000 | 130,000 | **150,000** | 170,000 | 190,000 | 210,000 |
| Operations - Staffing | 457,933 | 600,050 | 742,167 | **884,284** | 1,026,401 | 1,168,518 | 1,310,635 |
| TOTAL RETAINED | **547,933** | **710,050** | **872,167** | **1,034,284** | **1,196,401** | **1,358,518** | **1,520,635** |

| TRANSFERRED RISK | -15% | -10% | -5% | BASE | 5% | 10% | 15% |
|---|---|---|---|---|---|---|---|
| Construction Risk | 1,537,620 | 2,406,709 | 3,275,798 | **4,144,888** | 5,013,977 | 5,883,066 | 6,752,156 |
| Design Risk | 307,631 | 371,721 | 435,810 | **499,900** | 563,990 | 628,080 | 692,170 |
| Maintenance | 161,430 | 178,363 | 195,296 | **212,229** | 229,163 | 246,096 | 263,029 |
| Revenue for the Asset | 2,081 | 8,325 | 14,569 | **20,813** | 27,056 | 33,300 | 39,544 |
| TOTAL TRANSFERRED | **2,808,066** | **4,117,746** | **5,427,425** | **6,737,104** | **8,046,783** | **9,356,463** | **10,666,142** |
| TOTAL RISK | **3,355,999** | **4,827,795** | **6,299,592** | **7,771,388** | **9,243,184** | **10,714,981** | **12,186,777** |

These values from the previous page are then each placed in to a new Risk Adjusted PSC to give new PSC values, for example, when a +10% deviation is incorporated into the PSC, the Net Present Cost alters from the base of $143,448,326 to $148,110,411. The full spreadsheet analysis is included in Appendix Three and explained further in Chapter 5.

## 4.10. Apportionment and Analysis of Risks

The secondary analysis of risk that this report has undertaken on the PSC has been developed by reapportioning risks between the Public and Private sectors.

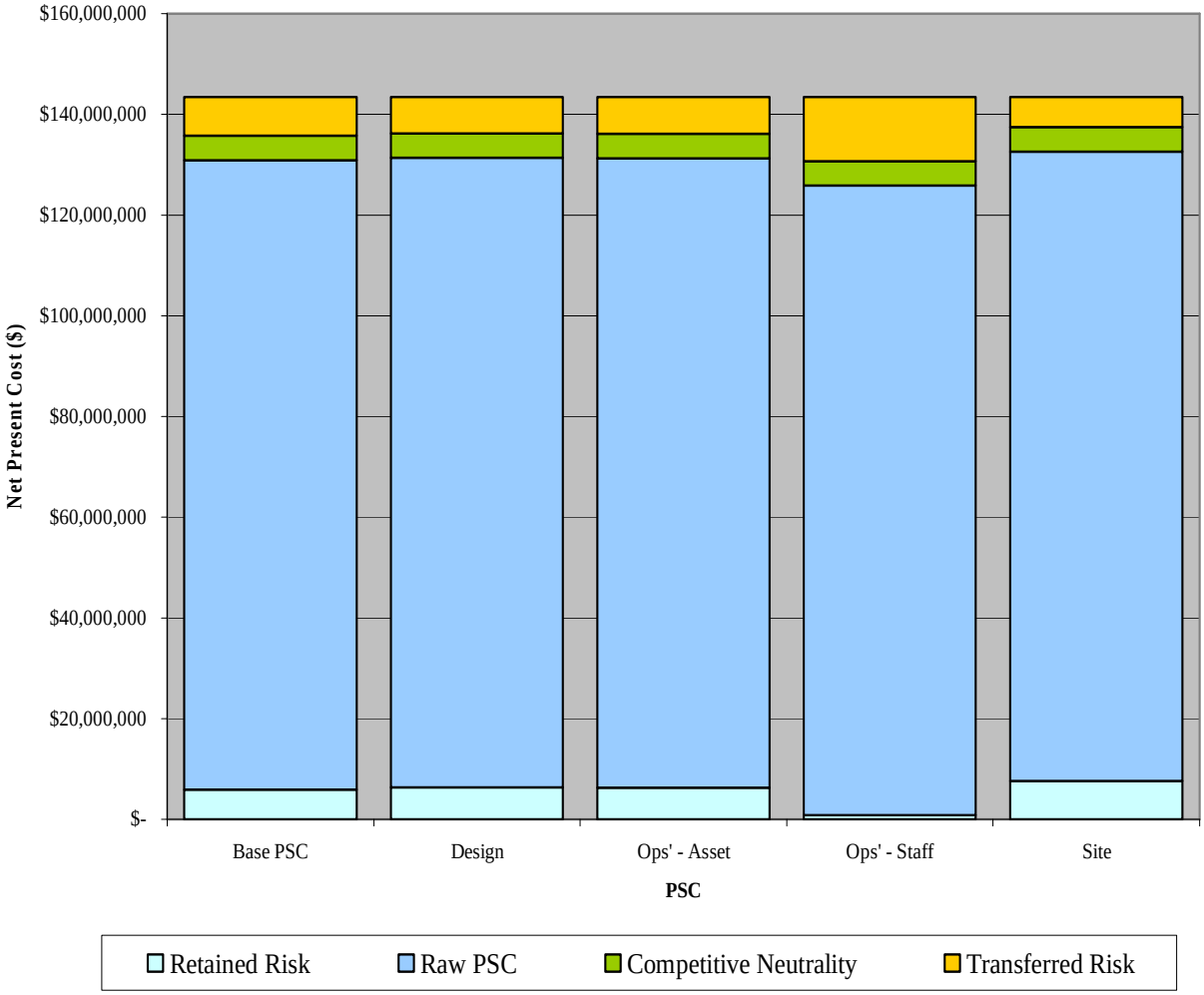
From the literature that identified the apportionment of risk in Table 6 on page 59, and the author's own experience, Design, Operations - Assets Management and the Site will be reapportioned by transferring them from the Private to the Public Sector. Operations - Staffing will be transferred from the Public to the Private sector. It is the author's opinion that Construction, Maintenance, Revenue from the Asset and Policy Changes will not undergo this reallocation, because they are currently allocated to the sector best adapted to manage the risk more efficiently and the change will be minor.

The reapportionment of risk was undertaken within the Risk Transferred PSC included in Appendix Four. Each risk was individually transferred within the Risk Adjusted PSC to show how transferring the risks would affect the overall Net Present Cost and distribution of the PSC after the transfer.

As postulated, without revaluing the value of risk, the overall Net Present Cost of the PSC did not change, however the percentage apportioned to each section of risk in the PSC made subtle changes. Finance and Operation – Staff made the most identifiable change to the PSC. When assessing the potential Value for Money of a PPP, as noted in Figure 1 on Page 27, these changes will have

an effect on the potential Service Payments expected from a consortium. Table 24 is a summary of these changes.

**Table 24:** Adjusted PSC Values Following Risk Reapportionment




| | Base PSC | Design | Ops' - Asset | Ops' - Staff | Site |
|---|---|---|---|---|---|
| **Transferred Risk** | $ 7,669,526 | $ 7,223,808 | $ 7,334,343 | $ 12,719,782 | $ 5,993,173 |
| **Competitive Neutrality** | $ 4,874,037 | $ 4,874,037 | $ 4,874,037 | $ 4,874,037 | $ 4,874,037 |
| **Raw PSC** | $ 124,997,839 | $ 124,997,839 | $ 124,997,839 | $ 124,997,839 | $ 124,997,839 |
| **Retained Risk** | $ 5,906,924 | $ 6,352,642 | $ 6,242,107 | $ 856,669 | $ 7,583,277 |
| **TOTAL PSC** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** | **$ 143,448,326** |

These results of the previous graph will be discussed further in Chapter 5.

## 4.11. Summary of Data

The chapter has demonstrated the following:

**Determine the risks**

Through the use of literature, the author has provided a basis of the top ranked risks that are commonly attributed to PPP's.

**Apportion risk**

Once again through literature, it has been illustrated how each of the identified risks can be apportioned between either the Public or Private sectors.

**Value and Analyse the Risks**

Through the authors creation of a Risk Matrix based on a Ball et al., (2003) sighted model, the author has ranked the level of risk by way of impact and probability, therefore being able to calculate a dollar value of the risks.

**Develop a Hypothetical School Project**

With the use of the Ministry of Education guidelines and online calculators, the report has developed a hypothetical School based on a roll of 1,050 students. From this information, an extensive list of assumptions based on published material has been developed.

**Develop a Public Sector Comparator**

A Public Sector Comparator has been developed by the author, based upon sighted versions in literature, especially the Victoria Partnership

model. The complete documents are included within Appendix Two and Three.

**Undertake a Sensitivity Analysis of the PSC**

By incorporating the Risk Matrix and Risk Register, the values of risk have been analysed in the form of a simple sensitivity analysis, based upon the total value of the PSC and a more detained analysis, based upon the individual impacts the risk would have on the project.

**Reapportion and Analyse the Risks**

By reapportioning Design, Finance, Operations - Assets Management and the Site from the Private to the Public Sector and Operations - Staffing from the Public to the Private sector, changes to the PSC have been identified.

# 5. FINDINGS AND CONCLUSIONS

## 5.1. Introduction

This research started in late February of 2010 and has developed into a document that the author has found challenging, frustrating and rewarding. The development of the Public Sector Comparator (PSC), even though based upon a published version, has shown the author that there are a number of variables that can not only affect the assessment of risk, but also the values that eventually come out of the PSC.

This research has attempted to analyse risk and demonstrate how it can affect the outcome of the Net Present Cost (NPC) of the PSC through both the transfer of risk between the Public and Private Sectors and through simple sensitivity analysis. It is the author's opinion that this has been achieved.

## 5.2. Findings

This research has shown that the development of a PSC and the assessment of risk can be greatly affected by assumptions and personal opinions of the person or party undertaking the assessment. The creation of the case study school project, called Project College, was intended to demonstrate how risks could be simply valued and included within the PSC. It was shown that if these assumptions are subtly changed, the result is a shift of the NPC of the project.

The analysis of risk was undertaken in three ways. First, a sensitivity analysis was developed for the Risk adjusted PSC, secondly the Impact of risks also underwent a sensitivity analysis and finally, the specific risks were reapportioned between the Public and Private sectors and analysed. The following are the findings of these three assessments.

**Findings on the Sensitivity Analysis of the PSC**

The sensitivity analysis of the PSC involved taking the Net Present Cost (NPC) of the PSC, in this case $143,448,326, and deviating it in increments of 5% between -15% and +15%. This analysis was to show how the base assumptions changed with the predetermined percentage changes.

The total NPC for each risk was individually varied by the above percentages to demonstrate how the overall value of the PSC would change. Table 22 on page 89 was a graphical representation of this assessment. The largest variable was to the Operations - Staff, which had its value altered by $9,078,231 between +/- 15% and the lowest change was to Policy Changes, which resulted in a change in value of only $151,000. The following is a detailed assessment of each cost based.

**Construction**

- The value of Construction related costs included in the PSC was $34,182,463. Following a deviation of -15% the NPC was revised to $138,320,956 and with a +15% deviation, a value of $148,575,695 was identified. Each 5% change resulted in a $1.709m adjustment the PSC. The maximum combined deviation was +/- $5,127,369. This was the second highest change and illustrates that it is more sensitive to change than other risks.

**Design**

- The value of Design related costs included in the PSC were $2,601,046. Following a deviation of -15% the NPC was revised to $143,058,169 and with a +15% deviation a value of $143,838,483 was identified. Each 5% change resulted in a $130,052 adjustment the PSC. The maximum deviation was

+/- $390,157. This was the second lowest change and illustrates that it is less sensitive to change than other risks.

**Maintenance**

- The value of Maintenance related costs included in the PSC were $21,346,153. Following a deviation of -15% the NPC was revised to $140,246,403 and with a +15% deviation a value of $146,650,249 was identified. Each 5% change resulted in a $1.067m adjustment the PSC. The maximum deviation was +/- 3,201,923. This was the third highest change and illustrates that it is more sensitive to change than other risks.

**Operations - Asset**

- The value of Operations - Asset related costs included in the PSC were $8,440,645. Following a deviation of -15% the NPC was revised to $142,182,229 and with a +15% deviation a value of $144,714,423 was identified. Each 5% change resulted in a $422,032 adjustment the PSC. The maximum deviation was +/- $1,266,097. This change illustrates that it is less sensitive to change than other risks.

**Operations - Staffing**

- The value of Operations - Staff related costs included in the PSC were $60,521,542. Following a deviation of -15% the NPC was revised to $134,370,094 and with a +15% deviation a value of $152,526,557 was identified. Each 5% change resulted in a $3.026m adjustment of the PSC. The maximum deviation was +/- $9,078,231. This was the highest change and illustrates that it is most sensitive to change than any other risk. It was postulated previously in this report that this

risk could be the most sensitive to change, which through this analysis, has been confirmed.

**Policy**

- The value of Policy related costs included in the PSC were $1,006,669. Following a deviation of -15% the NPC was revised to $143,297,326 and with a +15% deviation a value of $143,599,326 was identified. Each 5% change resulted in a $50,333 adjustment of the PSC. The maximum deviation was +/- $151,000. This was the lowest change and illustrates that it is the least sensitive to change than other risks. This shows that even though it was sighted as a predominant risk in the literature, the value of the risk in this project is almost insignificant in considering the total value of the project.

**Revenue**

- The value of Revenue related costs included in the PSC were $3,481,805. Following a deviation of -15% the NPC was revised to $143,970,596 and with a +15% deviation a value of $142,926,055 was identified. Each 5% change resulted in a $174,090 adjustment of the PSC. The maximum deviation was +/- $522,271. This was the third lowest change and illustrates that it is less sensitive to change than other risks.

**Site**

- The value of Site related costs included in the PSC were $14,107,575. Following a deviation of -15% the NPC was revised to $141,332,189 and with a +15% deviation a value of $145,564,462 was identified. Each 5% change resulted in a $705,379 adjustment of the PSC. The maximum deviation was +/- $2,116,136. This was the slightly lower than the

average change and illustrates that it is slightly less sensitive to change than other risks.

Based on the above analysis, the following is the order of sensitivity of the PSC.

**Table 25:** Order of Sensitivity of the PSC

| | | |
|---|---|---|
| Operations - Staff | 1 | Most Sensitive to Change |
| Construction | 2 | |
| Maintenance | 3 | |
| The Site | 4 | |
| Operations - Asset | 5 | |
| Revenue | 6 | |
| Design | 7 | |
| Policy | 8 | Least Sensitive to Change |

**Findings on the Sensitivity Analysis of the Impact of Risks**

The secondary sensitivity analysis was based on analysing the impact of risk within the Risk Register. This was to show that secondary to a broad analysis of the PSC, a more detailed assessment of the risks could be undertaken to show which risk, and potentially the assumptions within the risk, are susceptible to change. In this assessment only the total value of risk included in risk register and future Risk Adjusted PSC was analysed.

As in the first sensitivity analysis, each of the impacts of risk were deviated by 5% between -15% and +15%. The results illustrated in Table 23 on page 90 identified that Construction risk was the most sensitive to change and Revenue the least. The order of sensitivity is illustrated on the following page Table 26.

**Table 26:** Order of Sensitivity of the Impact of Risk

| | | |
|---|---|---|
| Construction | 1 | Most Sensitive to Change |
| The Site | 2 | |
| Operations - Staff | 3 | |
| Design | 4 | |
| Maintenance | 5 | |
| Policy | 6 | |
| Operations - Asset | 7 | |
| Revenue | 8 | Least Sensitive to Change |

There are clear differences between the sensitivity analysis of the PSC and the sensitivity analysis of the impact of risk. In both cases Construction and Operations –Staff are in the top three and Policy and Revenue are in the bottom three. This could potentially show that although the value of the risk could change, there are underlying factors that affect how they relate to sensitivity analysis.

The Site and Design were two items that made the most noticeable shift between the two assessments. The rest of the risks made only subtle changes in order and were evenly spread.

As noted in section 4.8 of Chapter Four, a +10% deviation in the impact of risk was included in a Risk Adjusted PSC and the Net Present Cost altered from the base of $143,448,326 to $148,110,411.

**Findings on the Reapportion and Analyse the Risks**

The final assessment of the PSC was to reapportion Design, Operations - Assets Management and the Site from the Private to the Public Sector,

and Operations - Staffing from the Public to the Private sector. These changes to the PSC were identified in Table 24 on Page 92. This analysis was undertaken to show how the reapportionment of risks included in the PSC altered the composition of the PSC. In each case the Raw PSC and Competitive Neutrality values did not change.

The total value of the PSC did not change, because only the location of the risks within the Risk Adjusted PSC were changed and not the value. In Appendix Four are the four PSC spreadsheets that identify the simple effect of transferring these risks. In reality, only after the consortiums Service Payment bid was incorporated with the Public Sectors retained risk, would the real assessment of reapportioning risk and therefore Value for Money occur. As the value of this is far too speculative, this assessment has not been undertaken.

For the purposes of assessing the reapportionment of risk within this report the following have been identified:

**Design**

- The Design risks were transferred from the Private to the Public sector and became a Retained risk within the PSC. The total Retained risk increased by $445,781 or 7.5%, equally the Transferred risk decreased by $445,781 but in this case the change was only 5.8% of the base value.

**Operations - Asset**

- The Design risks were transferred from the Private to the Public sector and became a Retained risk within the PSC. The total Retained risk increased by $335,183 or 5.7%, equally the Transferred risk decreased by $355,183 but in this case the change was only 4.4% of the base value.

**Operations - Staffing**

- The Design risks were transferred from the Public to the Private sector and became a Transferred risk within the PSC. The total Retained risk decreased by $5,050,256 or 85.5%, equally the Transferred risk increased by $5,050,256 but in this case the change was 65.7% of the base value.

**The Site**

- The Design risks were transferred from the Private to the Public sector and became a Retained risk within the PSC. The total Retained risk increased by $1,676,353 or 28.8%, equally the Transferred risk decreased by $1,676,353 but in this case the change was only 21.8% of the base value.

These results show that Design and Operations – Asset have very little effect on the overall composition of the PSC. The Site has an increased effect but from both the literature and the author's experience, it is not normal for the Public Sector to take this risk. The largest influence was the Operations – Staff which proved to have a massive effect on the composition on the PSC.

## 5.3. Conclusions

Risk. Construction is inherently full of risk, whether it is using the appropriate construction materials, trusting a design, valuing work or someone's safety while on a site. Risk is intrinsic in the price we pay for the unknown or the assumed. The amount we have to assume creates uncertainty and therefore cost, which is eventually passed on to the entity prepared to accept it or mitigate against it. A Public Private Partnership (PPP) could be seen as the ultimate in risk apportionment when considering other procurement methods.

The idea of potentially transferring all of the design, construction and operating risk from the Public Sector to the Private Sector for a predetermined sum over the next 25-30 years must sound like good commercial sense.

This research report has attempted to evaluate risk in terms of PPP procurement, notably how it influences the value of the project. It has been shown that risk is sensitive to deviation and this affects the Net Present Cost (NPC) or value of the project. Alternatively, when a risk is reapportioned, the Value for Money of the project can alter as potential Service Payments increase or decrease in relation to the level of Retained and Transferred risks.

This research has demonstrated that the transfer of risk can be valued and assessed in a variety of ways. The basic sensitivity analysis of the PSC was demonstrated in Table 22 on page 89. This analysis demonstrated that staffing a school is the most sensitive in terms of the overall PSC. On the other hand Policy Changes had the least sensitivity even though it was highly sighted and discussed by the majority of authors in the sourced literature. When reapportioning risks, once again the staffing of the school ranked in the top tier of sensitivity.

The conclusion of the staffing of a school being the most sensitive to risk and deviation has further consequences. The Ministry of Education has made specific reference to the fact that they do not wish the staffing of a school to be transferred to the Private Sector. It is unclear to the author whether this is a wise move considering the current issues with Teacher pay negotiations and historical strikes and industrial action.

Based on the Ministry of Education's current new school procurement of the Single Line Accountability Guaranteed Maximum Price model, which is working very well, it does not appear logical to 'invest' all the time and effort into procuring a project under a 'operation-less' PPP. The Ministry of Education's PPP procurement is purely a GMP with maintenance of the asset

added. The question for future research is what the real benefits are; literature available to date has not been able to answer this.

There has been a sizable amount of literature on PPP's, much of which has focused on the Public Sector Comparator (PSC) and the assessment of risk. The referenced literature has allowed the author to identify and value risk, as well as develop a working PSC, which it is anticipated could be used by his employer.

If there is one conclusion to be made from this report it is that PPP procurement and the PSC is based on assumptions and the views of the group of individuals preparing it. These assumptions could create inaccurate results and possible unreliability when assessing the true Value for Money compared to a typical procurement model.

## 5.4. Limitations of Research

There are many limitations that this research has undergone, moreover for the authors inability to undertake a preferred Qualitative study using open discussions with construction professionals.

The use of literature has allowed this research to demonstrate that there is some form of consensus between published authors on the type of risks that can be incorporated in the development of a PSC. This literature is based upon overseas projects and there has been very little published from a New Zealand context, which would be expected as projects come on stream in the future.

It is acknowledged that the real assessment of risk should come from those parties developing the actual project and an understanding of the point from which they wish to either retain or transfer a risk. A consortium would have

access to a multitude of professionals that can assess and rate risk. The likes of KPMG, who have been sighted in the report, have specialist teams that 'crunch' the intricacies of Discount Rates and Life Cycle Costing to provide a basis for the development of a PSC. The author has concluded that even through these professionals demonstrate a far more rigorous assessment for the PSC, the basic 'nuts and bolts' of the PSC is cost, risk and who should pay for it.

The PSC is a forecast. It is an estimate and an assumption based on the best ability of the professional developing it to guess what a consortium will 'tender' as the value of their Service Payments. These 'guesses' are highly subjective and researchers such as Grimsey et al., (2005 page 358) note that it can be "manipulated to show what ever the users require it to show", which the author concurs with. However, as the author has demonstrated in the production of the PSC, there is value in producing an expected cost of the project. If not a PSC then some other form of assessment is required, which could potentially have similar issues.

## 5.5. Recommendations

It is the author's recommendation that, based on the level of publically available information, there needs to be more research undertaken in determining the benefits of PPP procurement and the valuation of risk for a New Zealand context. There appears to be basic New Zealand guidelines in place for Government organisations to be able to undertake the standardised development of a Public Sector Comparator. The author recommends this should be developed before the 'flood gates' open and PPP procurement is proposed for any type of project.

The author is aware of consultants from Australia assisting the Government in developing business cases for potential PPP projects, but the information from these is unlikely to be passed on to the wider construction industry. In some cases, it is assumed that potential New Zealand consortia will seek offshore consultants and experience when they develop their assessment of potential Service Payments. It is the recommendation that consortia source overseas experience as they increase their knowledge base on PPP procurement.

Finally the author recommends that for a school to be procured under a PPP method, the Ministry of Education seriously consider allowing the Private Sector to control the Staffing of the schools. It has been shown that the staffing costs are the highest portion of the overall cost of the project, and it is postulated that the Private Sector may have the ability to set and control wage levels and working conditions. It is noted that even as this report is being completed, Teachers and the Ministry of Education are at a stalemate in pay talks. If the Government chooses not to transfer this cost, then the author sees little benefit (apart from maintenance that could be procured separately) in not undertaking the project under the current Single Line Accountability model (GMP, Design and Build), which is working very well.

## 5.6. Future Research

There is a massive amount of research that could be undertaken on Public Private Partnerships and their intricacies. This report has attempted to give an overview of the basic ideas and show how risk can be valued and assessed.

This research would benefit from developing a risk matrix that questioned a large pool of respondents to give the ability to show a greater standard deviation, and potential increased accuracy of results.

There was a large amount of literature that discussed the Discount Rate and how this is the real driver behind the PSC, which the author concurs with.

The following are potential research ideas that could be undertaken in the future:

- Discount Rates and how they alter the Net Present Cost?
- Does a PPP give value for money against a GMP contract?
- What is the NZ context on PPP procurement?
- How accurate has a PSC been in relation to Private Sector bids?
- Can a different form of procurement give a similar outcome as a PSC?
- Is there value in analysis risk using complex statistical methods?

This research has shown that there is a massive amount of information for the New Zealand construction industry to learn and develop and hopefully researchers will push the boundaries rather than ‘copy’ the UK or Australia.

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# APPENDIX ONE

## Identified Risks by Author

**Bing, L., Akintoye, A., Edwards, P. J., and Hardcastle, C. (2005),** ***Construction and Architectural Management, 12.***

- Nationalisation of Assets
- Poor public decision making
- Strong political opposition
- Poor financial markets
- Inflation volatility
- Interest rate volatility
- Influential economical events
- Legislation changes
- Changes in tax regulation
- Industrial regulation change
- Level of public opposition to project
- Force majeure
- Geotechnical conditions
- Weather
- Environmental
- Land acquisition
- Demand for the project
- Available finance
- Financial attractiveness to project investors
- High finance costs
- Delay in project approvals and permits
- Design deficiency
- Construction cost overruns
- Construction delays

- Basic construction related issues
- Insolvency/default by subcontractors or suppliers
- Operation cosy overruns
- Operational revenues being lower than expected
- Lower operating productivity
- Maintenance costs higher then expected
- Organisation and co-ordination risks
- Inadequate experience in PPP
- Inadequate distribution of responsibilities and risks
- Staff crises.

**Brady, K.B, New Zealand Controller and Auditor-General (2006).**

- Design and construction
- Operation and maintenance
- Patronage and revenue
- Technology and obsolescence
- Legislative and political change
- Failing to obtain statutory approvals or re-approvals during the term of arrangement
- Financial.

**Grimsey, D. and Lewis, M. (2005)**

- Design
- Financial
- Project management
- Construction delays
- Cost overruns

**Infranews (2006)**

- The site
- Design and commissioning

- Employees
- Demand
- Force Majeure and uninsurable events

**Jefferies, M and McGeorge, G. (2008) Public-Private Partnerships:**

- Physical conditions
- Construction, design
- Technology
- Operation and maintenance
- Form of finance
- The return
- Demand for the product
- Political
- Legal risks with the type of contract
- The market
- Environmental impacts

**Jin, X.H. (2009)**

- Financial
- Construction

**Jin, X.H., Hemanta, D. (2008)**

- Nationalisation of Assets
- Poor public decision making
- Strong political opposition

**Khadaroo, I. (2008)**

- Site
- Construction
- Time

- Overruns
- Maintenance
- Operating
- Regulatory
- Force majeure

**Lonergan, R. (2004).**

- Completion date
- Changing public requirements
- Does the product deliver the required outcomes
- Inflation risk
- Cost overruns
- Future underlying costs
- Industrial action
- Physical damage to the asset
- Demand risk
- Reduced revenue

**Marques, R. and Berg, S. (2009)**

- Planning
- Construction
- Maintenance and major repairs
- Operation
- Technological
- Performance
- Demand
- Capacity
- Financing
- Inflation
- Legal

- Regulation
- Public contestation
- Force Majeure

**National Audit Office. (2009). Private Finance Projects.**

- Increased commercial risk
- Increased finance complexity
- Reduced contract flexibility
- Termination costs
- Workforce issues

**New South Wales Auditor General. (2006).**

- Design risk
- Construction risk
- Operating risks
- The payment mechanism
- Interest changes

**Ng, A. and Loosemore, M. (2007)**

- Credit risk
- Construction risk
- Revenue structures
- Operating risks
- Financial and legal structures

**Partnerships Victoria policy (2001)**

- Commissioning risk
- Construction risk
- Demand (usage) risk

- Design risk
- Environmental risk
- Financial risk
- Force major risk
- Industrial relations risk
- Latent defect risk
- Operating risk
- Performance risk
- Changing law risk
- Residual value risk
- Technology obsolescence
- Upgrade risk

**Quiggin, J. (2004)**

- Construction
- Operation
- Service specification
- Demand and market risk
- Regulatory risk
- Networks risk
- Systematic and unsystematic risk

**Waterview Steering Committee (2008)**

- Site risk
- Design construction and commissioning risk
- Operating risk
- Demand risk
- Market risk
- Policy change
- Force majeure

# APPENDIX TWO

## Risk Adjusted Public Sector Comparator

# APPENDIX THREE

## 10% Sensitivity Adjusted Risk Adjusted Public Sector Comparator

# APPENDIX FOUR

## Risk Transferred Public Sector Comparator