

OXFORDSHIRE COUNTY COUNCIL

BID FOR TRANSPORT ASSET MANAGEMENT FUNDING:

The Innovative use of data in Flood Prevention and Drainage Asset Management

1.0 Summary

1.1 Aims

- To use improved asset and condition information with predictive modelling and other technology to control or reduce the risk of weather events, flooding and climate change to buildings, highways and land
- To work in partnership to develop strategies, procedures and maintenance regimes that significantly reduce the impact of adverse weather and the relative costs of reactive response and maintenance
- To improve the quality and performance of drainage systems
- To produce accurate and accessible drainage records that incorporate data from various sources and agencies
- To significantly contribute to the delivery of outcomes stated in the Memorandum of Understanding between Oxfordshire County Council and the UK Climate Impacts Programme (UKCIP)
- To deliver a process of adaptation for key service areas that other service areas can learn from and use

1.2 Objectives

This work will enable us to:

- Identify the areas of highest risk and to manage them
- Limit potential damage to property, bridges, highways and land
- Ensure efficient use of resources

1.3 Outcomes

- The development of prioritised and targeted programmes of work based on revised appraisal criteria, improved asset data and climate information
- The provision of cost-effective, sustainable solutions that consider the wider drainage environment
- Close community and partnership working
- Maintenance regimes that are routine, appropriate and timely
- Less potential for hazardous ponding or ice formation due to blocked pipes and surcharging gully's
- More accurate predictions
- Safer roads
- Less damage and disruption
- Organisational and procedural efficiencies
- Reduced 3rd party claims
- Greater public satisfaction

2.0 Background

2.1 Flooding

There has been a significant increase in the incidence and severity of highway and river-related flooding events in recent years. This appears to be caused by a number of factors, namely climate change (higher intensity rainfall), more run-off from land, housing developments and impermeable surfaces, an ageing drainage infrastructure and inadequate maintenance due primarily to under-funding.

This culminated in the exceptional flooding that occurred in July 2007. Oxfordshire was one of the worst hit counties. Damage to highway infrastructure alone amounted to over £1 million, with roads and bridges being particularly affected. The cost to the emergency services and other Council departments was considerably more, and the effect on land and private property substantial.

A number of major rivers in Oxfordshire burst their banks, including the Thames and the Evenlode. Flooding occurred in highly populated areas within Oxford and Abingdon where water levels came within centimetres of causing considerably more widespread damage. Elsewhere, highway drainage systems were unable to cope with excess flows from land drainage flows due to lack of design capacity, damaged components or infrequent servicing.

2.2 Pitt Report

Oxfordshire County Council embraces the recommendations of the Pitt report. The strategy outlined in this bid aligns with the Pitt recommendations, and progress has been made on a number of fronts. The government response to the Pitt Report is due in December, and we await this with interest.

2.3 Asset Inventory

Oxfordshire's drainage network is one of our largest assets. It has been built up in a mostly ad-hoc manner over time, and much of it remains unrecorded, unquantified or unidentified. The older drainage records are often inaccurate, incomplete or out of date. Furthermore, the location and condition of drainage systems has not been routinely recorded. Although we have now begun the process of improving our database of drainage inventory, to comprehensively collect information across the whole network is a considerable task. We are therefore adopting a targeted approach by concentrating first on the areas of the network that present the highest risk.

3.0 Strategy

3.1 Risk Management Plan

Oxfordshire County Council is developing its asset management strategy to plan and respond to adverse weather events and climate change. The strategy involves identifying the locations that are most susceptible, and where the risk of damage, disruption or hazard is greatest. A key element of this work relates to the control and alleviation of flood risk through the innovative and informed use of data, collaborative working and value management. This is the main thrust of our funding bid. However, alongside this work, we are also developing a risk management approach to dealing with extremes of temperature and wind. Construction and condition data and the use of local climate models will facilitate this work. The most risk-prone areas will be identified and materials and measures specified that address the various problems. This approach will be applied to carriageways, structures and other vulnerable assets and will set a precedent for work elsewhere on the highway network.

4.0 The Innovative use of Data

4.1 Cause and Effect

The main aim of this project is to gain a detailed understanding of the factors that contribute to flooding and drainage problems at high risk locations, and of their cumulative effect. Information will be gathered from a variety of sources, and inter-relationships explored to enable risk to be managed in the most cost-effective and sustainable manner. Fundamental to this work is a detailed knowledge of the inventory, condition and performance in service of the highway assets in these areas, and their potential to deal with future demands and changing environments. Essential also, is an understanding of the likelihood, frequency and impact of types of weather event at different locations in the County.

4.2 Climate Modelling - UKCIP

Oxfordshire County Council has entered into a Memorandum of Understanding with the UK Climate Impacts Programme (UKCIP) to develop our response to climate change across the County Council's functions. The objectives of the partnership with UKCIP align very closely with the aims and objectives of this particular project and the bid for funding (for information, the Memorandum of Understanding of the partnership is reproduced at the end of this report). Through this collaboration we will be using various tools and data provided by UKCIP to identify areas within the County that present a high risk to our infrastructure and its ability to deal with changing weather patterns. The primary tool will be the UK Climate Projections 2009 (UKCP09).

4.2.1 UK Climate Projections 2009

UKCP09 is due for release in early 2009. It is the fifth generation of UK climate change scenarios and predicts the likely changes to UK climate during the 21st century. UKCP09 will be the most comprehensive package of climate information produced for the UK to date, and will provide users with observed climate information, marine projections and probabilistic climate projections through a dynamic user interface:

- for all 25 x 25 km UK land grid squares
- for aggregated regions, including administrative areas and river basin areas and with the potential to analyse event clusters and their effect on more localised areas
- for changes in monthly, seasonal and annual averages, with potential to provide additional predictive information about extreme weather events such as the hottest day of summer and wettest day of winter
- that can be used to drive a weather generator - a tool that provides a statistical expression of baseline and projected climate at daily intervals
- together with other features and elements

Consequently, UKCP09 will allow users to interrogate the climate models to produce customised output for local and geographically wider areas

4.3 Working in Partnership

Oxfordshire County Council has been proactive in arranging regular meetings at strategic (Director) level with the Environment Agency, land drainage authorities, emergency services and Thames Water. At a local level, there is considerable engagement between County Council officers, district and parish council's, councillors and land owners. Local flood committees have been established with key stakeholders to share knowledge and resources, and to develop more collaborative working and a co-ordinated response to flood management.

The collection and sharing of data is paramount. The County Council has produced overlay maps that combine data from various organisations. This includes Environment

Agency 1 in 100 and 1 in 1000 year flooding maps, records of flood defence locations, water authority records, the locations of properties affected by flooding, the proximity of vulnerable users, and key elements of infrastructure such as power stations and busy routes. Our work in developing our knowledge of highway drainage assets and the effects of climate on them will assist us in developing surface water development plans. By collating and sharing this information, we will be able to plan and prepare more efficiently, and target work pro-actively to the areas where it is most needed. Clearly, there is considerable merit in further developing the universal collection and integration of this and other key information.

4.4 The Use of Historic and Predictive data

We are compiling a database of locations where flooding and drainage incidents have occurred, or where weather has in other ways impacted on the function or performance of highway assets. For drainage incidents, the likely frequency of such events will be assessed by recording or researching the particular rainfall intensities, and other factors, that contributed to problems at particular locations. The climate model will then be analysed along with other available information to determine the extent of the problem, and its priority compared with other sites. Similarly, the predictive tools will be used to identify locations that may present a risk in future and may lead to those sites receiving more frequent maintenance, or upgrading, or requiring compliance with particular standards for new construction.

The resultant data will be incorporated electronically within our existing highway management systems. It will be made accessible to officers and published on the County Council's public website. It will be made available to the Emergency Services and will form an intrinsic part of the County's Strategic Emergency Planning. The information will also be shared with the Environment Agency and other parties to assist with the refinement of their models, impact assessments and flood-alert processes, and their forward programmes of work.

The data will also inform the County Council's own work programmes. A range of measures will be provided depending on circumstance and the best whole-life cost solutions. The implications for sustainability and future maintenance will feature largely in this.

5.0 Improvement Plan

5.1 The following key actions are proposed:

- Identify the areas of the network most at risk from severe flooding and ponding (recent and historic)
- Use climate modelling to predict the future location of local high-intensity rainfall areas and correlate with other available flood-risk data
- Undertake a comprehensive collection of drainage asset inventory in the identified areas, supported by site investigation, camera surveys and condition assessment
- Use this information to identify constraints in the network that can critically impair capacity, and take steps to remove them
- Bridge inspections - accumulations of sediment around river structures will be considered as a trigger for routine maintenance in future. Existing records will be reviewed
- Determine if the flooding or drainage problems can be resolved at a local level or if the flood risk is compounded by external factors

- Work with the Environment Agency, district and parish councils, riparian owners and other parties in the identification of contributory factors, and the measures to ameliorate them
- To ensure the solutions do not give rise themselves to unacceptable impacts on other parts of the network
- Promote and support the establishment of Flood Committees among Parish Council's in flood-prone areas to provide information concerning off-highway drainage problems and to feed into the works prioritisation process
- Compile surface water management plans
- Clean, repair or provide drainage elements as necessary in high risk areas
- Ensure that new infrastructure utilises sustainable techniques where practical, and commence retro-fitting of SUDS (Sustainable Drainage Solutions)
- Record all drainage inventory in high risk areas using GPS
- Map all drainage runs electronically and update as necessary
- Display electronic drainage records via the highway management system and public website
- Assign cyclic maintenance regimes to each element as appropriate and monitor regularly
- Tailor maintenance budgets to suit
- Build up cost/benefit models to qualify the measures and to quantify the effects over time

5.2 Term Maintenance Contract

The County Council's Highway's term maintenance contract is due for renewal in 2010. The contract will be let for a proposed minimum period of 10 years and will provide a very integrated approach to asset management. This is an excellent opportunity for ensuring there is adequate resource and capability to innovate, and deliver, against the objectives in the Improvement Plan.

6.0 Progress to date

- Development of policy for the prioritisation of drainage improvement works. The Policy is now being further updated to include more detailed assessment of cost/benefit and risk
- Establishment of the 'Longer Term Flood Issue Group' with main agencies and stakeholders. Promotion of local Flood Committees together with funding and support
- Partnering arrangements and Method of Understanding established with UKCIP - funded and resourced
- A formal review of the drainage function was carried out last year – one of a series of Business Process Reviews aimed at identifying and embedding process and efficiency improvements across the Oxfordshire Highways partnership. A Service Level Agreement for drainage is now being trialled as a result of this work.
- Gully Inventory - work is currently underway to log all gully locations by GPS, and to identify those that present a higher risk and require more frequent cleaning
- The budget for drainage improvement work (capital) has been quadrupled during the last 5 years. The intention is to increase allocations in real terms year on year
- The budget for gully cleaning has been increased significantly in 2008/09 to facilitate the comprehensive identification, logging and cleaning of highway gullies countywide
- Hard copy drainage records have been scanned electronically at a cost of approximately £70k

- Approval has recently been obtained to create two additional Senior Engineer posts in the drainage team
- A 10 year partnering arrangement was established last year with Exor Corporation. We currently use v.4.0.2.1 Atlas and will shortly upgrade to v.4.0.5.1. Electronic works ordering and data capture devices are used routinely. The system allows us to log and interrogate condition information, incidents and costs more easily and more comprehensively, and to produce information utilising GIS. The public can register enquiries and report highway defects direct via the OCC website
- Maps combining drainage and other related information from various agencies have been produced
- Re-tendering of the Oxfordshire County Council term maintenance contract is currently at the pre-qualification stage

7.0 Drainage Expertise

7.1 National Awards

Oxfordshire County Council has received national awards for its work in implementing sustainable drainage solutions and for reinforcing its use in policy. The County Council is seen as a leader and innovator in this field and provides guidance, advice and presentations to local authorities nationally. These include:

- Talk on the Henry Box Development to the 2nd National Conference on Sustainable Drainage at Coventry University June 03
- Construction Excellence Award for Henry Box 2004
- CIRIA- present Maintenance of SUDS 05/06
- Advise to Cambridgeshire County Council on the Cambourne European Project 06
- CIRIA Landform – SUDS Presentation Nov 07
- New Civil Engineer SUDS talk 07
- New Civil Engineer SUDS talk Nov 08
- Cambridgeshire IHTE -SUDS talk Nov 08
- Groups visiting Oxfordshire to visit SUDS sites – local authorities, private firms, DEFRA
- Presentation on SUDs by OCC development control officer – Barbican, Autumn 2008

7.2 Working with Manufacturers

A number of drainage products have been commercially produced following recommendations made by our drainage staff (to ACO, etc). We have also recently worked with Marshall on technical guides for their porous paving.

7.2 Sustainable Drainage Solutions (SUDS)

For Section 38 works it is now County policy that a SUDS system will be investigated before any other solutions are considered. For instance, all peripheral roads will now normally be constructed with over the edge drainage to longitudinal swales. These may be constructed with check dams using local stone to slow the flow along the swale.

On estate roads we strongly promote the use of porous block paving for driveways, parking areas and pavements. Roof water may be connected to the porous pavements on payment of a commuted sum to the Highway Authority to cover a part share of future maintenance. Developers make savings as manholes, pipes, gullies and (sometimes) kerbs are not required.

These solutions can contribute significantly to controlling flood risk and reducing our future liability, by reducing run-off, and through the provision of storage. Other sustainable solutions have provided amenity space through the construction of storage

ponds and the use of planting to remove excess water. We promote the use of recycled materials in drainage construction.

8.0 Bridges

A number of highway bridges were damaged during the 2007 floods. Some bridges lost parapets, and others experienced impact damage and scour. Sediment accumulation was identified as a significant contributory factor in restricting the flow of water beneath many bridges, thereby adding to the risk of structural damage and flooding. The County Council has recently been involved in coordinated work with the Environment Agency on a number of high profile flood alleviation schemes in Oxfordshire, including the designation of sacrificial areas of land for water storage during flooding events.

We estimate that 70% of bridges over significant water-courses have problems of silt accumulation. Although diving inspections are undertaken to programme, a significant backlog exists in processing them. This problem will be addressed and silt accumulation afforded a higher priority in future. Routine silt removal for a 10m span bridge will cost an average of £20k. Budgets will be increased to fund the necessary work.

9.0 Project Cost Estimate

The areas in Oxfordshire most affected historically by flooding include 46 villages in West Oxfordshire and 8 in South Oxfordshire. The towns of Abingdon, Wantage and Grove have also been badly affected. The site investigation and inventory work will initially target these sites and other particularly susceptible locations. The estimated cost of this work is as follows:

Worst affected villages:	£575k
Abingdon:	£ 55k
Wantage & Grove:	£ 30k
Data Capture Devices:	£ 5k
Software upgrade:	£ 17k
Total:	£682k

The total figure excludes the cost of additional staff and contributions to UKCIP

10.0 Conclusion

Oxfordshire County Council is experiencing a significant increase in flooding and drainage related problems. To manage risk, and to provide effective and efficient solutions, it is necessary to identify, assess and register the existing drainage infrastructure, condition and constraints in risk-prone areas. Further benefits will be achieved by understanding existing drainage regimes and their likely effect on other areas, as well as their sensitivity to adverse weather conditions and climatic change.

We will collect sound asset information and utilise the latest predictive tools to generate a programme of targeted and prioritised works at high risk sites. This will compliment the innovative work that has already taken place with SUDS and will strengthen our collaborative working with the Environment Agency, local Councils, UKCIP, HR Wallingford and others.

Our aspirations for this project are that it will provide valuable information for the assessment of risk and benefit. It will result in the effective management and alleviation of flooding and ponding, the establishment of enduring maintenance practices, and be considered an exemplar of best practice nationally.

OCC: 17 December 2008

Memorandum of Understanding between

UK Climate Impacts Programme (UKCIP) & Oxfordshire County Council (OCC)

This Memorandum sets out an agreement between UK Climate Impacts Programme (UKCIP) and Oxfordshire County Council (OCC) to work in partnership to develop the County Council's response to the impacts of changing weather and climate. The Memorandum seeks to formalise the partnership (which hitherto has proceeded on an informal basis) and to make explicit the commitment of both parties.

Aims of partnership

The broad aims of the partnership are to:

- significantly advance OCC's commitment to incorporate adaptation within the organisation and its partnership programmes.
- specifically to progress work on adaptation to weather and climate within OCC in order to deliver a programme of work that meets both the LAA2 target and addresses the major risks to the authority identified by the Senior Management Board in 2007.
- allow OCC to make use of UKCIP expertise in the impacts and consequences of climate change and experience of the processes, research programmes, methodologies and policies that begin to address these impacts.
- allow the furtherance of UKCIP's aim of 'learning through doing' so that understanding gained by UKCIP in working with OCC can be shared with other UKCIP stakeholders.

Objectives

The following objectives have been agreed between the partners:

- continue joint work programme between UKCIP and OCC initiated in 2006;
- follow up and further integrate climate change adaptation into OCC risk assessment and business planning processes;
- set up systematic monitoring of the effects of the weather on OCC (services, estate & reputation) and identify impacts, costs and opportunities
- where appropriate introduce adaptation options for particular service areas and communicate the process and experience in ways usable by other service areas across the authority;
- review corporate risks and strategic issues;
- support the process for implementing the Sustainable Community Strategy
- support the process for achieving the LAA2 targets.

Outcomes

- To achieve corporate ownership of climate change adaptation reflected in processes such as the corporate risk assessment and other key longer term planning policies;
- To deliver a process of adaptation for four key service areas from which other service areas can learn and use in developing their own processes;

- To provide a coherent framework for the inclusion of adaptation considerations in business planning across OCC and where appropriate for partnerships and partner organisations.

Deliverables

- Completed further stages of the Local Climate Impacts Profile (LCLIP) and outputs made available to Service Heads and other users.
- An assessment of how best to establish a monitoring framework and processes for reporting the impacts and consequences (including costs) of extreme weather events.
- A joint UKCIP/OCC paper on the experience of introducing adaptation work into OCC, written, published and disseminated.
- LAA2 targets for Year 1 and Year 2 achieved and arrangements in place for achieving targets for Year 3.
- Detailed assessments and considered adaptation responses for selected key service areas.
- An action plan for further adaptation across the authority.

Resources and project management

Oxfordshire County Council

OCC agrees to support the work programme set out in this MoU with the assistance of:

- 0.5 fte member of climate change team for 2 years to lead and drive project.
- Input from county council risk manager and other service staff as required.
- Staff from Research and Intelligence team (Data Observatory).
- A fee not exceeding £20,000 payable to UKCIP over two years.

UKCIP

UKCIP agrees to support the work programme set out in this MoU and will provide the following:

80 person days over the plan period to provide support and guidance from UKCIP specialists to:

- provide specialist advice on topics indicated in work plan;
- participate/facilitate workshops;
- make presentations where appropriate;
- participate in project team and attend meetings as required;
- help prepare and comment on relevant documentation.

Means of delivery

A project brief and business plan will be developed, and steered by a small project team. Team members will include:

- Project Sponsor: a member of the County Council management team or head of service
- Project Manager: OCC/UKCIP rep
- The County Council risk manager

- Representatives from services including property, transport and children's services
- UKCIP Knowledge Transfer Manager and Project Officer.

Monitoring and reporting

Project monitoring will be achieved by four meetings a year of the Project Team including progress reports produced jointly by UKCIP and OCC Officers.

Provisional joint work programme

This needs to be designed to ensure that the county and district councils are in line to meet the objectives and milestones in the LAA2 target proposal. Drawing on the list above, this can be broken down into three main strands of work:

- **Corporate risk management:** ensuring corporate ownership across the authority of the need for a risk management approach to climate change. This should include monitoring and reporting arrangements, and communicating across the organisation.
- **Service-based plans:** working with key service areas we have identified to develop more detailed responses and provide experience and examples which could be used elsewhere.
- **Completing the Local Climate Impacts Profile:** further work is needed to establish a monitoring framework and determine key thresholds for service areas to prepare ground for using UKCIP09 climate data.

Timetable

The work will be timed over two years, from May 1 2008 to March 2010.

Signed by

Dr Chris West on behalf of UK Climate Impacts Programme

Signed by

Joanna Simons on behalf of Oxfordshire County Council