PLAN OF DEVELOPMENT (POD)
ENLARGEMENT OF OVERLAND RESERVOIR
GMUG National Forest, Paonia, Colorado, Ranger District

Project Proponent: Overland Ditch and Reservoir Company, Hotchkiss, CO
POD Author: Western Engineers, Inc.

Project Description:

The Overland Ditch and Reservoir Company (ODRC) proposes to enlarge the Overland Reservoir in order to supply supplemental irrigation water to the 20 sq. mi. service area, which generally includes the Redlands Mesa area near Lazear, Colorado. The Overland Reservoir is located in sections 22 and 23, T. 11S., R.92 W., 6th P.M., approximately 15 air miles north of Paonia, in Delta County, Colorado. The enlargement will store a conditional water right in the amount of 971 acre-feet currently held by ODRC.

Proposed Action:

The anticipated efforts will include work necessary to increase the normal reservoir level by 3.8 feet and will involve the following:

1. Raise the main dam and auxiliary dam crest elevations by about 2 feet and add rip rap needed to protect the embankment below the completed normal water surface.

2. Upgrade the auxiliary dam and a portion of the main dam to include internal and toe drainage, increase the crest width, add rip rap as necessary to protect the embankment below the completed normal water surface and add embankment to the downstream slope to flatten in to a more stable slope.

3. Raise the spillway crest level by 3.8 feet to allow for storage of the additional water. This will be accomplished by increasing the height of the existing concrete weir wall as well as the training and retaining walls.

4. Add emergency spillway capacity if necessary.

5. Remove timber from around the perimeter of the reservoir.

Work is anticipated to be completed in a single summer, beginning in May or June, weather permitting, with an anticipated completion time on or before November 30. Work is expected to take place during daylight hours only (typically 7 am to 7 pm) with a crew of 10-14 workers, including a supervisor, equipment operators, support staff, construction management, quality control and inspection staff, and periodic inspections by State and USFS personnel. At the contractor's discretion, a man camp may be used. If a man camp is used, it will be placed in the same area as the construction staging area – in the existing turn-around area north of the spillway structure. The staging area and camp will be confined to previously disturbed areas. The previously disturbed area at this location is estimated to be in excess of 0.5 acre. The

staging area and camp is expected to occupy an area of about 0.5 acre or less. The staging area will include parking for construction equipment and vehicles, equipment service trailer, generator, fuel storage (as applicable), field office, field laboratory, mobile housing and temporary storage for materials and tools.

Following is a list of anticipated construction equipment needed for the work (note that not all equipment will necessarily be on-site at one time):

2 scrapers
2 track excavators
1 water truck
2 dozers
1 loader
3 rock trucks
1 compactor
1 log skidder
1 log loader
Miscellaneous pickups and ATV support vehicles
Electric Power Generator
Welder/Cutting Torch

In addition to the above equipment on site, supplies and materials will be hauled to the project using semi tractor/trailers and personnel and minor materials will be transported by pickup and passenger vehicles. For daily construction traffic, it is anticipated that approximately 4 daily pickup round-trips will be needed if a man camp is not used for the project. If a man camp is used, the number of daily vehicles trips may be reduced. A sand filter drain system is required to be installed in the auxiliary dam and a portion of the main dam. The purpose of the drain is to minimize potentially unsafe pore water pressures within the embankment and foundation or the dam. Based on engineering and geotechnical evaluations, approximately 1,700 cubic yards (3,100 tons) of sand will need to be transported to the dam. No sand is available on site within the reservoir basin. Due to more difficult access from the staging area to the auxiliary dam, at the Contractor's option, the sand may be temporarily stockpiled at a transfer point. The transfer point will be located either within the staging area or, if insufficient area remains in the staging area, within a previously disturbed area nearby the staging area. Tandem dump trucks can drive to the transfer point and discharge their loads at this location. If the contractor so chooses, they will be allowed to haul the sand directly to the auxiliary dam without stockpiling at the transfer point. However, if the sand is stockpiled at the transfer point, it will be reloaded into construction haul vehicles and transported to the auxiliary dam. It is anticipated that the transfer point stockpile will be limited to less than 5,000 sq ft (0.11 acre). The total trips to the site are estimated as follows:

Sand and Gravel Hauling – 120 trips
Timber Removal – 20 trips
Fuel and Miscellaneous – 30 trips
Pickup and Passenger vehicles – 520 trips

Geotechnical investigations have indicated the presence of sufficient suitable material in two previously used borrow areas which will be used for completion of the necessary embankment improvements. Material will be excavated from the borrow areas and placed in loose lifts and then compacted to required specifications. Rip rap will be obtained from areas within and adjacent to the final reservoir perimeter. The Company will obtain a Mineral Materials Contract from the Forest Service for use of the borrow material and riprap. Borrowed materials will be placed and compacted per engineering standards approved by the Colorado State Engineer's Office SEO. At all times standard Best Management Practices (BMPs) will be used, such as sediment control downstream of the project site to assist in maintaining clean, sediment-free water in streams below the project. All work will be performed by a licensed contractor.

Access Needs:

There are two potential access routes from main highways to the reservoir site as shown on Figure 1:

1. From Interstate 70 – 10.1 miles east on state highway 65 toward Mesa/Collbran. 17.5 miles east on county road 330 through Collbran to the fork to Vega Reservoir. 7.6 miles east on county road 330E to the turn toward Buzzard Divide. 3.6 miles southeast on county road 73.4 to the Gunnison National Forest boundary. 15.2 miles southeast on primary National Forest System Road (NFSR) 265 to Dike Creek Campground. 2.4 miles southwest on primary NFSR 701 (Stevens Gulch Road) to the Overland Road. 4.4 miles west on secondary NFSR 705 (Overland Road) to Overland Reservoir.

2. From state Highway 133 near Paonia – 7.7 miles north on country road 40.10 (Stevens Gulch Road) to the Gunnison National Forest boundary where Stevens Gulch Road transitions to primary NFSR 265. 14.0 miles north on primary NFSR 265 to the Overland Road. 4.4 miles west on secondary NFSR 705 (Overland Road) to Overland Reservoir.

NFSRs 265 and 705 are designated for use by full-sized vehicles. It is anticipated that most of the heavy equipment to be used at the dam site will make one trip in at the beginning of construction work and one trip out following completion of construction. Unforeseen circumstances, such as equipment repairs that cannot be conducted on site, or the need to demobilize and remobilize for an additional construction season, may require additional trips. The maximum width of equipment is anticipated to be 11'.

In 2007, 3.9 miles of the 4.4 mile long Overland Road (NFSR 705) were improved to accommodate heavy vehicle traffic related to a timber sale. As part of the Overland Reservoir enlargement work, the final 0.5 miles of this road will be improved by the ODRC to similar conditions as applied to the lower 3.9 miles of road for the timber sale. Road improvements will be done primarily in advance of construction work commencing on the dam and will be done to Forest Service specifications and in accordance with the Road Use Permit issued by the Forest Service. If road conditions allow, and as approved by the Forest Service, some equipment mobilization may start prior to completion of the road improvements. If necessary, due to the conditions of the road, equipment will be unloaded at the end of the existing improvements and

roaded the final 0.5 miles. After completion of this road improvement work, the access roads will be sufficient to accommodate mobilization and demobilization of the required equipment as well as other pertinent traffic, subject to certain restrictions:

1. All repetitive traffic such as sand, gravel and timber hauling will use the Stevens Gulch Road access.

2. Heavy traffic loads will not be hauled on the Stevens Gulch Road in the spring until the roadbed has sufficiently dried and stabilized from snowmelt as determined by the Forest Service, generally early to mid June.

3. For repetitive traffic, ODRC will conduct periodic grading maintenance to control washboarding and rutting, depending on traffic volumes and weather conditions.

4. ODRC will contribute to routine maintenance and gravel surfacing replacement costs in accordance with a formula agreed to between the Forest Service and ODRC in advance of construction.

Wetlands:

The proposed construction will result in possible impact on wetlands in the following areas:

1. A short section of the main dam embankment may be extended downstream. All of the new embankment will be placed outside of wetlands areas. However, construction may result in disturbance of areas beyond the limits of permanent features and perimeter of 20 feet beyond these limits will encroach on a maximum of 670 ft^2 (0.015 acre) of wetlands. This includes the area which will be disturbed during installation of a new subsurface filter drain. This area will be mitigated in place and is considered a temporary impact.

2. The auxiliary dam embankment will be extended downstream, encroaching on a maximum wetlands area of 12,026 ft^2 (0.276 acres). Of this area, 4,620 ft^2 (0.106 acres), represents the area which will be disturbed during installation of the new subsurface filter drain and a perimeter area (20 feet beyond the limits of permanent construction features) which may be disturbed by construction activities, both of which will be mitigated in place and are considered temporary impacts.

3. The access road to the auxiliary dam will be improved for construction traffic which will include increasing the width of a short section which crosses a wetlands area. This will result in disturbance of 210 ft^2 (0.005 acre) of wetlands.

4. A temporary road to one of the borrow areas will cross a drain ditch which has been categorized as wetlands and will result in disturbance of 200 ft^2 (0.005 acre) of wetlands. This area will be restored but may be part of the emergency spillway and is, therefore, considered to be a permanent impact.

5. An emergency spillway channel may be constructed on the right end (looking downstream) of the main dam which will disturb 2,500 ft^2 (0.057 acre) of wetlands. It is likely that most of this area can be mitigated in place, but it has been assumed that it will consist of a permanent impact.

It must be noted that final designs have not been completed and the above figures represent maximum potential wetlands disturbance. For example, the main dam embankment may not be extended downstream, the auxiliary dam embankment may not be extended as far downstream as indicated, and the emergency spillway may not be needed.

It is anticipated that none of the existing wetlands areas will be adversely impacted by the increased reservoir level. The basis for this conclusion is presented in Appendix A to this Plan.

An estimate of the expected increase in fringe wetlands was made assuming that, wherever wetlands currently exist near the existing reservoir perimeter or extend to, or past, the existing reservoir perimeter, the fringe wetlands will expand past the existing boundary of the wetlands to a line 1.5 feet in elevation above the proposed final high water level. Examination of the existing wetlands areas suggests that it is common for wetlands to exist on slopes up to 25 percent. Therefore, no new fringe wetlands were assumed to develop in areas with ground slopes in excess of 25 percent. The resulting increase in fringe wetlands area was estimated to be 328,520 ft^2 (7.542 acres).

Table 1
Wetlands Impact and Mitigation Calculations
Total Temporary and Permanent Impacts and
Net Gain of Wetlands

Item Description	Area (ft) [acres]	Temporary Impact (Acres)	Permanent Impact (acres)
Existing Wetlands to be Impacted by Main Dam Construction	670 [0.015]	0.015	0.00
Existing Wetlands to be Impacted by Auxiliary Dam Construction	12,026 [0.276]	0.106	0.170
Existing Wetlands to be Impacted by Auxiliary Dam Access Road Improvements	210 [0.005]	0.00	0.005
Existing Wetlands to be Impacted by Temporary Borrow Area Haul Road	200 [0.005]	0.00	0.005
Existing Wetlands to be Impacted by Emergency Spillway Channel	2,500 [0.057]	0.00	0.057
Mitigation: New Fringe Wetlands Created by the Enlarged Reservoir Perimeter	328,520 [7.542]	0.00	7.542
Net Gain (Loss) of Wetlands	312,914 [7.184]	0.121	7.305

Note: Temporary impacts are not included in the calculation because they will be re-established in place.

Appropriate permitting and mitigation planning will be completed with the U.S. Army Corps of Engineers for these minor impacts. With the expansion of the reservoir perimeter, the result will be a net gain of at least 7.305 acres of wetlands (Table 1).

Design Criteria:

The following list presents the design features by resource category. This section includes both measures required by law and regulation and those agreed to between the ODRC and the FS to minimize the environmental impacts of the Proposed Action:

Air:

1. Air quality will be maintained by permitting of all regulated air pollution sources through the Colorado Department of Public Health and Environment (CDPHE), Air

Pollution Control Division, assuring compliance with all federal and state standards. Federal and, hence, State law requires that fugitive dust be controlled on contiguous construction sites where more than 25 acres of ground are disturbed and the project is longer than six (6) months in duration. The Overland Enlargement Project site will not have more than 25 acres of disturbance at any given time or in totality, and the duration of construction is not anticipated to last more than 6 months. Therefore, no Air Pollution Emissions Notice will be required[1].

2. Such additional methods and devices as are reasonable to prevent, control and otherwise minimize atmospheric emissions or discharges of air contaminants will be used, including:

   a. No burning of combustible construction materials and rubbish. Burning of slash may be allowed, pending USFS approval, provided the risk of fire spreading is extremely low, and any USFS and appropriate local burn permits are obtained.

   b. A dust-preventative treatment or water may periodically be applied to access and haul roads as needed to minimize dust.

Noise:

1. Noise pollution will be minimized by compliance with applicable laws and regulations regarding the prevention, control and abatement of harmful noise levels.

Historical and Archaeological Resources and Paleontology:

1. All employees of the Company, its contractors, subcontractors, consultants or other parties associated with the project will be instructed that, upon discovering evidence of possible prehistorical, historical or archeological objects, work will cease immediately at that location and the Company's engineer or his representative will be notified, and provided with the location and nature of the findings. The FS will be notified as soon as practicable. Care will be exercised so as not to disturb or damage artifacts or fossils uncovered during excavation operations.

2. Equipment operators will be informed that the removal, injury, defacement or alteration of any object of archaeological or historic interest is a federal crime and may be punishable by fine and/or imprisonment.

3. During project implementation, in the unlikely event of an inadvertent encounter of Native American remains or grave objects, the Native American Graves Protection and Repatriation Act (NAGPRA) requires that all activities must cease in their discovery area, that a reasonable effort be made to protect the items found or unearthed, and that immediate notification be made to the FS Authorized Officers as well as appropriate Native American group(s). Notice of such a discovery may be followed by a 30-day construction delay (NAGPRA Section 3(d)). Further actions may also require

[1] From the Colorado Department of Public Health and Environment, http:/www.cdphe.state.co.us/ap/down/landdevelop.pdf

compliance under provisions of the National Historic Preservation Act of 1966 (NHPA) and the Archaeological Resources Protection Act.

Water/Hydrology:

1. Implementation of Best Management Practices as described in the soils section below would minimize effects, such as sedimentation, on Cow Creek from construction activities.

Soils:

1. A Stormwater Management Plan (SWMP) will be incorporated into the design drawings. The final, approved design drawings will be submitted to the Forest Service upon approval by the SEO, and at least 30 days prior to the anticipated start of construction. The plan will describe how wastewater from general construction activities, such as drain water collection, drilling, grouting or surface runoff from disturbed areas or other construction operations will not enter flowing or dry watercourses without the use of approved turbidity control or containment methods. Approved turbidity control methods for surface runoff include Best Management Practices such as drainage swales and ditches, detention basins, straw or coconut fiber wattles placed in swales, weed free hay bales placed to trap sediment, and guard or drainage trenches surrounding disturbed areas when suitable to the topography of the land. No discharge is anticipated from drilling operations. The only geotechnical drilling that will be required may be installation of piezometers in the embankment and in the foundation of the dam after construction of the embankment is complete. This will not require any discharge of free flowing water. Grouting is not anticipated.

2. Sediment and erosion control Best Management Practices will be employed to the extent practicable prior to work involving site clearing, stripping, grubbing and stockpiling topsoil, excavation and earthwork. The sediment and erosion controls shall be maintained in functional condition and repaired as needed during the course of construction.

3. A Spill Prevention, Containment and Countermeasure Plan (SPCC plan) will be prepared and submitted to the Forest Service for approval at least 30 days prior to the anticipated start of construction. The SPCC shall state that refueling or lubricating and storage of hazardous materials, chemicals, fuels, etc., will only take place in designated locations that are more than 100 feet from wetlands and other water bodies or drainages. Secondary containment will only be required if tanks are non-mobile. Mobile lubricating and fuel units will not require secondary containment. The SPCC plan shall outline what actions and BMPs should be taken in case of a fuel or lubricant or other hazardous material spill.

4. Excavated materials or other construction materials will not be stockpiled or wasted near or on stream banks, lake shorelines or other watercourse perimeters where they

can be washed away by high water or storm runoff, or can in any way encroach upon the watercourse itself.

5. Soil disturbing actions will be avoided during long periods of heavy rain or wet soils to prevent excessive rutting and mobilization of sediment during runoff events. Rutting in the project area is acceptable to the extent that it is not contradictory to obtaining compaction standards required by the SEO.

6. During construction activities, initial clearing operations will fully contain material on-site and not allow material to move into wetlands or into the riparian zone. Excess excavated material and construction debris developed along roads near streams will be disposed of in an area outside of the riparian and wetland areas.

7. Upon completion of construction, the Company will re-grade, prepare a seed bed and reseed temporary road improvements that are intended to be abandoned.

8. No mobilization of equipment or use of equipment will be allowed when it will cause undue damage to existing roads and trails. Undue damage done to roads must be repaired by the Contractor per USFS requirements.

Reclamation:

A comprehensive reclamation plan will be included in the Contract Specifications. The Specifications will be submitted to and approved by the FS prior to construction.

1. Seed

   a. Grass seed will be from the same or previous year's crop. When available, certified weed-free seed will be provided. All seed will be free of prohibited noxious weeds (as defined by the State), and will contain no greater than 1 % other weeds.

   b. All sites will be seeded with the following mixture as required by the USFS:

Table 2 Revegetation Seed Mix

Species	Lbs/acre PLS	% of Mixture
Mountain Bromegrass	5	26
Slender Wheatgrass	3	16
Thickspike Wheatgrass	3	16
Canby Bluegrass	3	16
Blue Wildrye	5	26
Total	19	100

Temporary Revegetation

Species	Lbs/acre PLS
Tall Wheatgrass/Winter Wheatgrass (Regreen (brand name)	20 lbs/acre

c. Seed will be furnished and delivered premixed in the indicated proportions. Seed bag tags, or the equivalent, shall be provided for each delivery of seed. Tags shall show the guaranteed percentages of purity, weed content, germination, net weight, date of seed testing and date of shipment.

2. Seedbed Preparation

a. If possible, a minimum of 6 inches of topsoil, borrowed on-site, will be placed over all areas disturbed during construction, with exception of borrow areas within the reservoir basin, which shall be smoothed over, but not reseeded. The seeding will be limited to those areas of disturbance above the normal final pool elevation.

b. Topsoil will not be placed in water or while frozen or muddy conditions exist.

c. Topsoil shall be track compacted to approximately 80 to 90 percent standard Proctor Density, ASTM D-698, to an appropriate tilth, density, consistency and friability to provide a suitable growth medium for sprouting and seedling survival.

d. All areas will be graded to drain. The maximum slope steepness will be 2.5 H:1 V unless otherwise shown on the project drawings or approved in writing by the Company's engineer.

e. The final surface of the topsoil will be graded to a relatively smooth surface using mechanical or hand raked methods. Localized low spots shall be regraded to allow water to drain.

3. Seed Application

a. Seeding will typically be accomplished between September 1st and October 30th. No seeding will take place when soils are frozen or excessively wet or dry.

4. Monitoring and Completion of Reclamation

a. All seeded areas shall be maintained in good condition, reseeded and mulched if and when necessary, until a good, healthy, uniform growth is established over the entire area seeded and until vegetation is established.

b. On slopes, washouts and rills deeper than three (3) inches deep shall be re-graded and reseeded and the reseeded area maintained until vegetation is established.

c. An area will be considered to be satisfactorily reclaimed when: a) soil erosion resulting from the operation has been stabilized and b) a vegetative cover at least equal to that present prior to disturbance and a plant species composition at least as desirable as that present prior to disturbance has been established.

d. Areas not demonstrating satisfactory reclamation as outlined above, will be renovated, reseeded and maintained meeting all requirements as specified above.

Vegetation:

1. Preventative actions will include the cleaning of vehicles and equipment prior to bringing them into the project area. This will include washing of transport tractors and trailers and all equipment prior to entering all USFS lands. Inspection of washed equipment will be required by the FS, at least initially.

2. Certified weed-free seed mixtures shall be used for all reclamation, as described above.

3. Treatments will be developed using integrated weed management principles for each species and situation. Treatments may include hand pulling, grubbing, mowing, mulching, seeding, burning, herbicide application and soil management.

4. Monitoring of noxious weeds will be conducted on a scheduled basis to detect new infestations, evaluate prevention and/or treatment success, and identify the need for retreatment.

Wildlife (including Aquatic Wildlife and Special Status Species):

1. Pre-construction surveys have been conducted. If any special status species or habitat is found to be present, the Company will coordinate with the FS to determine the most effective means of mitigating or precluding impacts. No special status species have been located.

2. For the Colorado River fishes, construction practices which maintain existing stream flows and minimize siltation and pollution will protect these species. Best Management Practices described above for soil and water will meet this objective.

Hazardous Materials and Emergency Response:

l. The Company will prepare and submit to the FS for approval, a Spill Prevention, Containment and Countermeasure Plan (SPCC plan) to satisfy applicable Federal and State requirements.

2. A Fire/Emergency Response/Health and Safety Plan that addresses the potential for accidents and injuries, and other emergencies will be prepared and submitted to the FS for approval and kept onsite. This plan will be made available to the FS prior to construction and kept on all active locations.

Solid and Sanitary Waste:

1. All solid wastes (trash) that result from construction activities shall be contained in a metal bear-proof trash cage. All material in the trash cage shall be removed from the location and deposited in an approved sanitary landfill.

2. Portable toilets will be provided for construction workers at the construction site and the work camp. These will be maintained and removed by the Company or their designated Contractor as appropriate.

Travel Management and Roads:

l. The Company will obtain a Forest Service Road Use Permit in advance and approved in writing a minimum of 30 days before construction begins.

2. Project-related vehicular traffic will be restricted to approved locations. Operational equipment will be restricted to the road prism and construction site at all times.

3. Mobilization and demobilization of heavy equipment will be scheduled during the week and not on weekends or Federal holidays to avoid high public traffic periods.

4. Management of surface water run-off, soil stabilization and limiting travel to a single, recognized route will be priorities. All stream crossings and soft areas shall be armored and permanently stabilized unless otherwise directed by the USFS.

5. Road Maintenance: NFSRs and NFSTs will be maintained according to Forest Service road management objectives. Existing NFSRs currently open for use will also receive pre-haul maintenance depending upon their condition and the needs of the project. Pre-haul maintenance will not include road reconstruction or repairs of an extraordinary nature, but may include maintenance of drainage structures, grading the road surface, corrections to cut/fill failures, spot rock applications and rolling dips,

etc. The Company will consult with the FS on the degree and manner of preconstruction maintenance, road reconstruction, and ongoing maintenance that will be required. The details of intended road improvements are contained within this document (above).

6. No berms of material will be left on the sides of the roadway during maintenance activities that will impede surface drainage.

7. Maintenance and reconstruction of roads will be done in a manner so as to minimize sediment discharge into streams, lakes and wetlands.

8. The Company's contractor will sign the project area roads in accordance with the "Manual on Uniform Traffic Control Devices" (MUTCD), latest edition, to notify the public to expect occasional construction traffic.

9. The Company will consult with the FS on the removal of road improvements and the eventual degradation of the roads to their pre-construction condition.

APPENDIX A

Analysis of the Impact of Periodic Inundation on Wetlands and Fens
Western Engineers, Inc.

Historical Reservoir Level Elevation versus Fill/Drawdown Time

In order to evaluate the time increments during which wetlands and fen areas have historically been inundated by the reservoir, fill/drawdown data was collected for the period since 1987. This data was obtained from: 1) Official storage records maintained by the Colorado Division of Water Resources; 2) Instrument monitoring records from the files of the ODRC and the Colorado Division of Water Resources, Dam Safety Department; 3) Official ditch diversion records from the Colorado Division of Water Resources; 4) Personal records of the local water commissioner of Colorado Division of Water Resources); and 5) First-hand observations of ODRC and Western Engineers.

The historical records provide nineteen (19) years of water level history data (from 1988 through 2007) for Overland Reservoir (no records were available for the year 1991). Because the measurements are periodic, the exact dates for fill and start of drawdown are not generally identified. These dates were interpolated using a combination of the following methods:

- The fill and drawdown Reservoir Level Elevation (RLE) vs. time (month/day) slopes were extended to full stage (Figure A-1) as appropriate.

- It was possible to compare the interpolated fill RLE vs. time slopes with the range of typical slopes to judge their reasonableness. This was possible because of the consistency in fill RLE vs. time slopes between known data points (Figure A-1).

- Time brackets were estimated when drawdown would have likely started. This estimation was made from the records of ditch diversions (both diversion initiation date and quantity). The rate of ditch diversions also provided a means to check the RLE vs. time slope during the early stages of drawdown.

- The magnitude of spills provided a means to estimate time brackets for both fill date and date of drawdown initiation. This estimate was made possible by records maintained by the local water commissioner of spill flows since 2004.

It should be noted that there was generally sufficient data so that the actual date for either fill or start of drawdown would not deviate from the estimated date based on the interpolation by more than a few days.

The resulting historic RLE vs. time patterns are shown on Figure A-1. The lowest point of the historically inundated wetlands and fens experiences the greatest inundation time of the wetland/fen areas. In other words, these points have historically been and will continue to be subject to longest submergence. The lowest point for historically inundated wetlands is delineation point N11 (refer to the JD request, WestWater Engineering 2007) at an elevation of 9,876.04 feet. The lowest point for historically inundated fen is delineation point F6-9 at an elevation of 9,886.73 feet. The wetland and fen delineation elevation is shown in Figures A-1 through A-6 for comparison.

Estimate of Wetland (Including Fen) Inundation Duration

In order to visualize the range of historic wetlands inundation time intervals, the RLE vs. time data was normalized so that each year is centered at its maximum fill point (Figure A-2). This was done by shifting the time reference for each year's data so that a zero date occurs either at the point of maximum storage or at the middle of the full stage time period. This also allowed for determination of a median RLE vs. time relationship. It should be noted that there was no individual year which closely matched the median of the daily data, so the median RLE vs. time curve was determined based on connection of daily median values rather than selection of a single year's data to represent the median. The normalized data are shown on Figure A-2. The zero date shown was determined as described above with the negative date values representing the fill part of the cycle and the positive date values being the drawdown portion of the cycle. The following conclusions can be drawn from the data:

- The reservoir did not fill for four (4) of the 19 years evaluated (1988, 1990, 2000 and 2002). This means that during these 4 years the upper-most portion of the historically inundated wetlands and fen areas were not submerged. In 2002, the driest year during this period of record, the reservoir filled to only about half of its capacity and the maximum reservoir level elevation was 9,882.58 ft, significantly below the lowest elevation point in the fen areas. Therefore, in 2002 none of the fen areas were submerged and the lowest wetland point was submerged by a maximum of about 6.5 feet.

- Excluding the year 2002, the year which exhibited the shortest duration of wetland/fen inundation was 1990 (Figure A-3).

- The year during which the greatest duration of wetland/fen inundation occurred was 2005 (Figure A-3).

- The median curve, determined as described above, is also shown on Figure A-3.

Summary of Historical Overland Reservoir Wetland and Fen Inundation

Tables 2 and 3, below, tabulate a summary of the range of wetlands inundation periods at the current OHWL (9,896.5 feet), at the proposed future OHWL (9,900.3 feet), at the minimum historically inundated wetland elevation (9,886.73 feet) and at the minimum historically inundated fen elevation (9,876.04 feet) for both the historic data at the current OHWL and the projected values at the future proposed OHWL. The wetlands growing season was estimated to extend from June 2 through September 19 (see report entitled "Periodic Inundation Of Wetlands At Overland Reservoir Technical Report, December, 2008" prepared by Western Engineers and WestWater Engineering). Tables 4 and 5 present the portion of the growing season during which the wetlands and fens were exposed to the atmosphere at the four reference elevations listed above.

Table 2. Inundation Period of Wetland/Fen at Current and Proposed OHWL

Ordinary High Water Level Condition	Inundation Period (Days) At Original OHWL (Elevation = 9,896.5 feet)	Inundation Period (Days) At Future OHWL (Elevation = 9,900.3 feet)
Minimum Year (1990) Current OHWL	**0** (did not fill)	Not Applicable*
Maximum Year (2005) Current OHWL	**60** (5/17 through 7/16, 2005)	Not Applicable*
Median, Current OHWL	**17**	Not Applicable*
Minimum Year (1990) Proposed OHWL	**0** (would not fill)	**0** (would not fill)
Maximum Year (2005) Proposed OHWL	**71** (5/17 through 7/27, 2005)	**52** (5/25 through 7/16, 2005)
Median, Proposed OHWL	**26**	**4**

*The inundation period for wetland/fen located at elevation 9,900.3 with reservoir operation under the current OHWL (elevation 9,896.5) is not applicable because the reservoir level never reaches elevation 9,900.3.

Table 3. Inundation Period (days) of Wetland/Fen at Minimum Elevations

Ordinary High Water Level Condition	Inundation Period (Days) at Minimum Wetland Elevation (9876.04 feet)	Inundation Period (Days) at Minimum Fen Elevation (9886.73 feet)
Minimum Year (1990) Current OHWL	**79** (5/16 through 8/3, 1990)	**37** (6/4 through 7/11, 1990)
Maximum Year (2005) Current OHWL	**134** (4/12 through 8/24, 2005)	**99** (4/30 through 8/7, 2005)
Median, Current OHWL	**93**	**56**
Minimum Year (1990) Future OHWL	**79** (5/16 through 8/3, 1990)	**37** (6/4 through 7/11, 1990)
Maximum Year (2005) Proposed OHWL	**144** (4/12 through 9/3, 2005)	**106** (4/30 through 8/14, 2005)
Median, Future OHWL	**99**	**64**

Table 4. Exposure Period (days and percent of growing season) During the Growing Season of Wetland/Fen at Current and Proposed OHWL

Ordinary High Water Level Condition	Exposure Period (days) At Elevation 9,896.5 feet (Current OHWL)	Exposure Period (days) At Elevation 9,900.3 feet (Proposed OHWL)
Minimum Year (1990) Current OHWL	**6/2-9/19=109 days (100%)** (did not fill)	Not Applicable*
Maximum Year (2005) Current OHWL	**7/16-9/19=65 days (60%)**	Not Applicable*
Median, Current OHWL	**6/21-9/19=90 days (83%)**	Not Applicable*
Minimum Year (1990) Proposed OHWL	**6/2-9/19=109 days (100%)** (would not fill)	**6/11-9/19=109 days (100%)** (would not fill)
Maximum Year (2005) Proposed OHWL	**7/27-9/19=54 days (50%)**	**7/16-9/19=65 days (60%)**
Median, Proposed OHWL	**6/30-9/1=81 days (74%)**	**6/17-9/19=94 days (86%)**

*The inundation period for wetland/fen located at elevation 9,900.3 with reservoir operation under the current OHWL (elevation 9,896.5) is not applicable because the reservoir level never reaches elevation 9,900.3.

Table 5. Exposure Period (days and percent of growing season) During the Growing Season of Wetland/Fen at Minimum Elevations

Ordinary High Water Level Condition	Inundation Period (Days) at Elevation 9,876.04 feet (Minimum Wetland Elevation)	Inundation Period (Days) at Elevation 9,886.73 feet (Minimum Fen Elevation)
Minimum Year (1990) Current OHWL	**8/3-9/19=47 days (43%)**	**7/11-9/19=70 days (64%)**
Maximum Year (2005) Current OHWL	**8/24-9/19=26 days (24%)**	**8/6-9/19=44 days (40%)**
Median, Current OHWL	**8/6-9/19=44 days (40%)**	**7/18-9/19=63 days (58%)**
Minimum Year (1990) Proposed OHWL	**8/3-9/19=47 days (43%)**	**7/11-9/19=70 days (64%)**
Maximum Year (2005) Proposed OHWL	**9/4-9/19= 15 days (14%)**	**8/14-9/19=36 days (33%)**
Median, Proposed OHWL	**8/10-9/19=40 days (37%)**	**7/20-9/19=61 days (56%)**

Comparison of Historically Inundated Wetlands and Fens with Wetlands and Fens Not Subject to Historical Annual Submergence

In a report entitled "Periodic Inundation Of Wetlands At Overland Reservoir Technical Report, December, 2008" prepared by Western Engineers and WestWater Engineering, technical data

from ongoing operations at Overland Reservoir was presented and evaluated that demonstrated effects of periodic inundation on wetlands, including fen. The report highlighted the persistence of wetland (including fen) during annual periodic episodes of inundation by Overland Reservoir operation. Close to twenty years of operating records were examined showing when wetlands and fen have been submerged (under water) by annual reservoir filling events. Based on observations made during the wetlands delineation, it was found that there were both similarities and differences between the inundated fens, and those not inundated. The delineation of the historically inundated wetland (including fen) areas suggest that these wetlands have remained functional and differences are relatively minimal compared to areas not previously inundated. In a letter dated March 25, 2008, the Corps of Engineers confirmed the boundaries of the wetland delineation, and therefore is aware of the existence of historically inundated wetland (including fen) which remain functional. The referenced report included the following observations and conclusions:

1. Historically, wetland submergence duration has varied up to 134 days, with a median duration of 93 days and fen submergence duration has ranged up to 99 days, typically lasting 56 days based on the median inundation period. The historically inundated wetlands and fens have persisted for nearly twenty (20) years throughout these periods of inundation. This is likely due to the fact that although submerged periodically, the wetlands are sufficiently exposed during the growing season.

2. The year during which the maximum submergence period occurred (2005) is critical. That is because, during the year with the longest inundation period, the portion of the growing season during which existing wetlands are exposed to the atmosphere is at its minimum.

3. A significant portion of the inundation period occurs prior to the growing season. The lowest elevation wetlands generally start to become inundated in late March and early April.

4. Wetlands currently persist in the reservoir basin at an elevation where exposure during the growing season is as short as 26 days (24 percent of the growing season) in the year with the shortest exposure during the growing season (2005). At this elevation (9876.04), the median period during which the wetlands are exposed during the growing season has historically been 44 days (40% of the total growing season).

5. Fens currently survive in the reservoir basin at an elevation where exposure during the growing season is as short as 44 days (40 percent of the total growing season) in the year with the shortest exposure during the growing season (2005). At this elevation (9886.73), the median period during which the wetlands are exposed during the growing season has historically been 63 days (58 percent of the total growing season).

6. The historical inundation evidence encountered at the Overland reservoir site suggests that the periodic inundation of these wetlands and fens may not have resulted in significant change and definitely has not resulted in a cease in function.

7. In respect to the wetlands delineation, there were relatively minimal noted differences between wetlands and fens that had been inundated by ongoing reservoir operations and those that had not.

Proposed Future Reservoir Level Data

In order to anticipate the effect of the proposed reservoir enlargement on the duration of wetlands (including fen) inundation time intervals, the RLE vs. fill time (for the 19 years of historic records which were considered) was projected to the proposed new maximum reservoir capacity. This was accomplished using the following considerations:

- The rate of fill (or, generally, the RLE vs. time curve slope) immediately prior to the reservoir reaching the full stage in each year can be used as a guide to establish the initial volumetric fill rate above the current OHWL.

- The volumetric fill rate above the current OHWL was estimated from the spill records maintained by the water commissioner (2004 through 2007).

- For the years in which no spill records are available, the volumetric fill rate for reservoir levels higher than the current OHWL was estimated. The rate of final volumetric fill prior to the reservoir level reaching the current OHWL varied from 71 to 292 acre-feet/day, averaging 181 acre-feet/day. For the lower final fill rates, it can be assumed that the daily fill rates would likely be declining. The RLE vs. time patterns prior to the peak storage levels for years in which the reservoir did not fill combined with the few years for which there were spill records can be used as templates for typical volumetric fill patterns. For the higher final fill rates, it is reasonable to assume that the daily volumetric fill rates were either increasing or would remain roughly constant for a short period of time before decreasing. It is possible to match the final volumetric fill rate patterns for each year evaluated with similar patterns exhibited by 1) years with more complete fill records such as years during which the reservoir did not fill; and 2) years for which spill records exist. In order to estimate this, the similar patterns in other years are used as models to estimate volumetric fill rates for each year evaluated.

The resulting proposed RLE vs. time patterns are shown on Figure A-4. The elevation of the lowest point of the historically inundated wetlands and fens are again shown on Figures A-4 through A-6.

Again, the RLE vs. time data was normalized in the same manner as the historical fill/drawdown data. This was accomplished in using the same procedure previously described. Each year's time reference was shifted so that a zero date occurs either at the point of maximum storage, or at the middle of the full stage time period (see Figure A-5).

For the 4 years (1988, 1990, 2000 and 2002) that the reservoir did not fill to the current OHWL, none of the wetlands or the small fen area located above the current OHWL would have been submerged. The data also reveals that the reservoir would not have filled to the future proposed OHWL for 6 of the 19 years (1989, 1992, 1998, 1999, 2001 and 2007). This means that about half the time some, or all, of the wetlands and the small area of fen between the current OHWL and the future proposed OHWL would have not been inundated at all (Figures A-5 and A-6).

The proposed future RLE vs. time curves for the minimum submergence duration year (1990), for the maximum submergence duration year (2005) and the median curve determined as described above, are shown on Figure A-6.

Projections Regarding Wetlands and Fens Which Will be Submerged Due to the Proposed Increase in OHWL

Tables 2 and 3 in this Appendix, tabulate a summary of the range of wetlands inundation periods at the current OHWL (9,896.5 feet), at the proposed future OHWL (9,900.3 feet), at the minimum historically inundated wetland elevation (9,886.73 feet) and at the minimum historically inundated fen elevation (9,876.04 feet) for both the historic data at the current OHWL and the projected values at the future proposed OHWL. These values were determined as previously described. A 3.11 acre area of wetlands between the current OHWL and the proposed final OHWL will be newly inundated. This includes 0.07 acre area of fens (a combination of portions of fens F-2 and F-6) predicted to be inundated as a result of the reservoir expansion.

The following discussion projects effects of the increase in OHWL:

1. In order to contrast the impact of the future OHWL from the proposed reservoir enlargement on the historically inundated wetlands and fens, the year during which the maximum submergence period occurred (2005) is critical. Additionally, the comparison must consider the lowest historical elevation of the inundated wetland or fen. This is because, after increasing the OHWL to the proposed future elevation, the total inundation period for all other years and at all other elevations at which historically inundated wetlands and fens were identified will be shorter than it would have been in 2005. The data for the year 2005 shows that an increase in OHWL from the current elevation to the future proposed elevation will result in a maximum increased submergence time increment for the lowest historically inundated wetland of 10 days (from 134 days to 144 days of inundation) and a maximum increased submergence time increment of 7 days (from 99 days to 106 days of inundation) for the lowest historically inundated fen. This is an increase of only 7% in inundation time duration for both the lowest historically inundated wetland and fen. This evaluation strongly suggests that wetlands and fen at Overland Reservoir will persist with future increases in inundation

2. The same rationale may be used to evaluate the potential effects that the increased OHWL will have on the area of newly inundated wetlands and fens. Again, 2005 is the critical year for comparative purposes. Additionally, the critical evaluation elevation is where the lowest newly inundated wetland or fen would occur, or the current OHWL. The data for the year 2005 shows that the increase in OHWL from the current elevation to the future proposed elevation would have resulted in a submergence time increment for the wetland and fen area at the current OHWL of 71 days, lasting only 26 days during a normal year based on the median inundation period. In 2005, the newly inundated wetland and fen areas at the proposed future OHWL would have experienced 52 days of inundation effects, with these effects lasting only 4 days during a normal year based on the median inundation period. This means that the average inundation period for the

wetland and fen areas which will be newly impacted by the increased OHWL will only be about 16 or 27 percent of the historical time increment found by observing the lowest elevation at which wetlands and fens (respectively) have been subjected to submergence in the past. Since the historically inundated wetlands (including fens) have survived with no significant observed deleterious effects it seems very likely that the wetland and fen areas which will be newly inundated by raising the OHWL to the proposed final elevation will be substantially less impacted than wetland and fen areas which have been historically inundated for longer periods of time. Therefore, it can be expected that the wetland and fen areas which will be newly inundated by raising the OHWL to the proposed future elevation will persist in the same manner as the wetland and fen areas that have been historically inundated for varying periods of time.

3. The proposed increase in OHWL will reduce the wetland exposure period for historically submerged wetlands during the normal growing season by 0 to 10 percent (with a median reduction of 6 percent) and will reduce the fen exposure period (percent of the growing season) by 0 to 7 percentage points (with a median reduction of 2 points).

4. At the minimum elevation at which the wetlands delineation identified wetlands (9876.04), the proposed increase in OHWL will decrease the median wetland exposure period during the normal growing season from 44 days (40% of the total growing season) by only 4 days.

5. At the minimum elevation at which the wetlands delineation encountered fens (9886.73), the proposed increase in OHWL will reduce the median fen exposure period during the growing season from 63 days (58 percent of the total growing season) by only 2 days.

6. The wetlands (including fens) which will be newly inundated as a result of the proposed increase in OHWL will be exposed for 81 to 94 days (74 to 86 percent) of the growing season during a median year. This compares with a range of 44 to 90 days(40 to 83 percent) of the growing season for wetlands in general and 63 to 90 days (58 to 83 percent) of the growing season for fens with the exposure experienced under the existing operating conditions during a median year with the current OHWL. In other words, the newly inundated wetlands and fens will be exposed for significantly longer percentages of the growing season compared with periods that wetlands and fens are currently exposed for. It is, therefore, reasonable to expect that the newly inundated wetlands and fens will be no more greatly impacted than the historically inundated fens and wetlands have been which appear to have persisted with little change based on observations made to date.

Although the wetlands delineation has been the only assessment to date, the observations made suggest that the effects of historic inundation have been relatively minimal and the water level and inundation duration data presented herein indicate that the increase in inundation duration for historically inundated fens and wetlands will be relatively minor. This data also suggests that the period of inundation for fens and wetlands which will be newly submerged as a result of the increase in OHWL will be substantially less than the historically inundated fens and wetlands have experienced.

Wind and Wave Action

The potential effects of wave action on the wetlands and fens which will be newly inundated were considered. The erosive effects of wave action are dependent on a number of factors including:

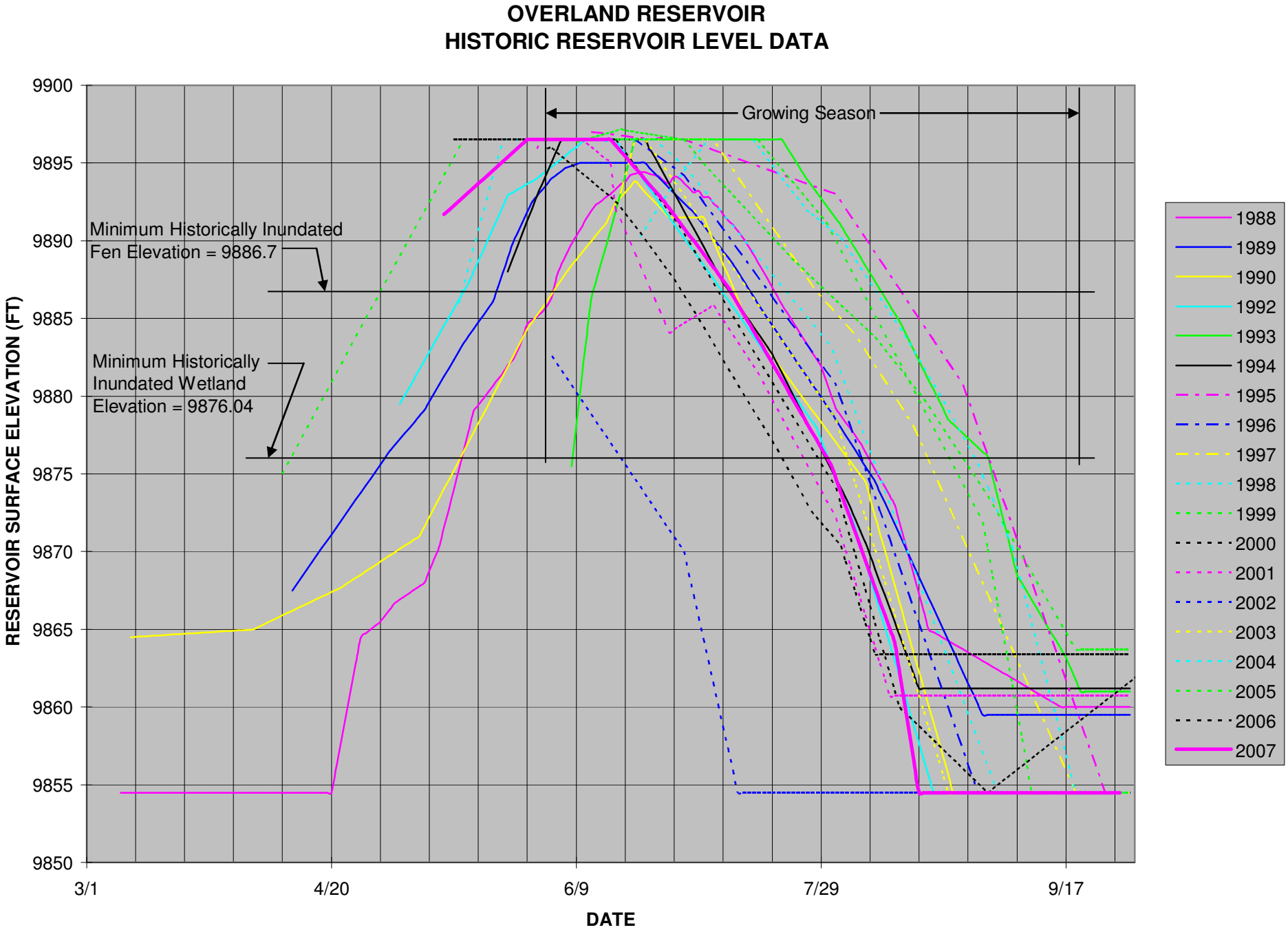
- Wave velocity, which is a function of wind velocity and duration.

- Wave height, which is a function of a combination of reservoir fetch, wind velocity and wind duration. Fetch is defined as the distance over which the wind can act on a body of water and is generally defined as the normal distance from the windward shore to the area being considered.

- The slope of the ground against which the waves impinge. Steeper slopes are more subject to wave generated erosion because the wave energy is absorbed by a smaller area.

The maximum wind velocity and duration will not change with the proposed increase in OHWL. The reservoir fetch relative to the fen area, which will be inundated as a result of the increased OHWL will change from 2,851 feet to 2,967 feet, an increase of 4 percent. Generally accepted relationships between the parameters mentioned above indicate that, with a wind velocity of 100 miles/hr and fetch less than one mile, wave height increases by 0.15 percent per percent of fetch increase. Therefore, the increase in wave height and resultant wave impact energy as a result of the increase in OHWL is insignificant. For example, if the wave height impinging on the subject fen area at the current OHWL is 3.0 feet, the increased wave height due to the raise in OHWL to the future proposed elevation would be 3.005 feet, an increase of about 1/16 of an inch.

The entire wetland and fen area below the existing OHWL has historically been subject to wave erosion as the reservoir level cycles between the future annual low elevation and the current OHWL. These previously inundated wetlands and fens have persisted in spite of this wave activity. However, the greatest potential for wave erosion is at the elevation of the OHWL because of the greater time increment during which the reservoir surface remains at that level. Historically, the time duration during which the reservoir level remains at the current OHWL has ranged from 0 to 60 days, averaging 17 days. The average ground slope for the fens at this elevation is 14 percent. After raising the OHWL to the proposed future elevation, the time increment during which the reservoir level will remain at the new higher OHWL will vary from 0 to 53 days, averaging 11 days. The average ground slope for the fens at the elevation of the future proposed OHWL is 13 percent. Wave action appears to only affect steep slopes on NW side of Reservoir. Because the time duration during which reservoir level remains at the OHWL will be less with the raised OHWL than it is with the current OHWL, and since the ground slope in the fen areas is less at the elevation of the future proposed OHWL than at the elevation of the current OHWL, the wave erosion potential at the reservoir margin near the newly inundated fens will be significantly less than it has been for the historically inundated fens, and the effects are not expected to be significant related to function of either wetlands or fens.


OVERLAND RESERVOIR
HISTORIC RESERVOIR LEVEL DATA
RESERVOIR SURFACE ELEVATION (FT)
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
Growing Season
Minimum Historically Inundated
Fen Elevation = 9886.7
Minimum Historically
Inundated Wetland
Elevation = 9876.04
3/1
4/20
6/9
7/29
9/17
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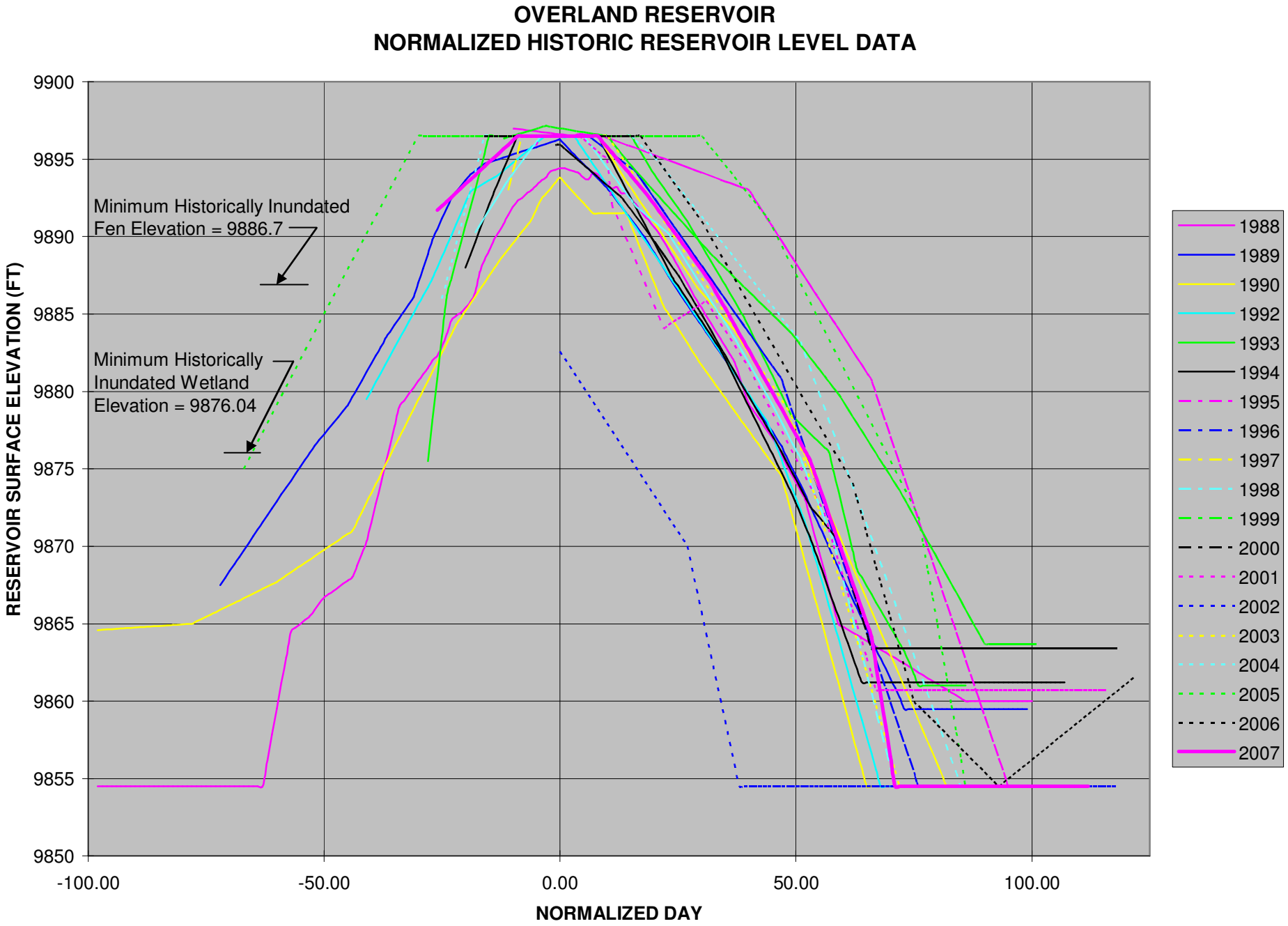
OVERLAND RESERVOIR
NORMALIZED HISTORIC RESERVOIR LEVEL DATA
RESERVOIR SURFACE ELEVATION (FT)
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
Minimum Historically Inundated Fen Elevation = 9886.7
Minimum Historically Inundated Wetland Elevation = 9876.04
-100.00
-50.00
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50.00
100.00
NORMALIZED DAY
1988
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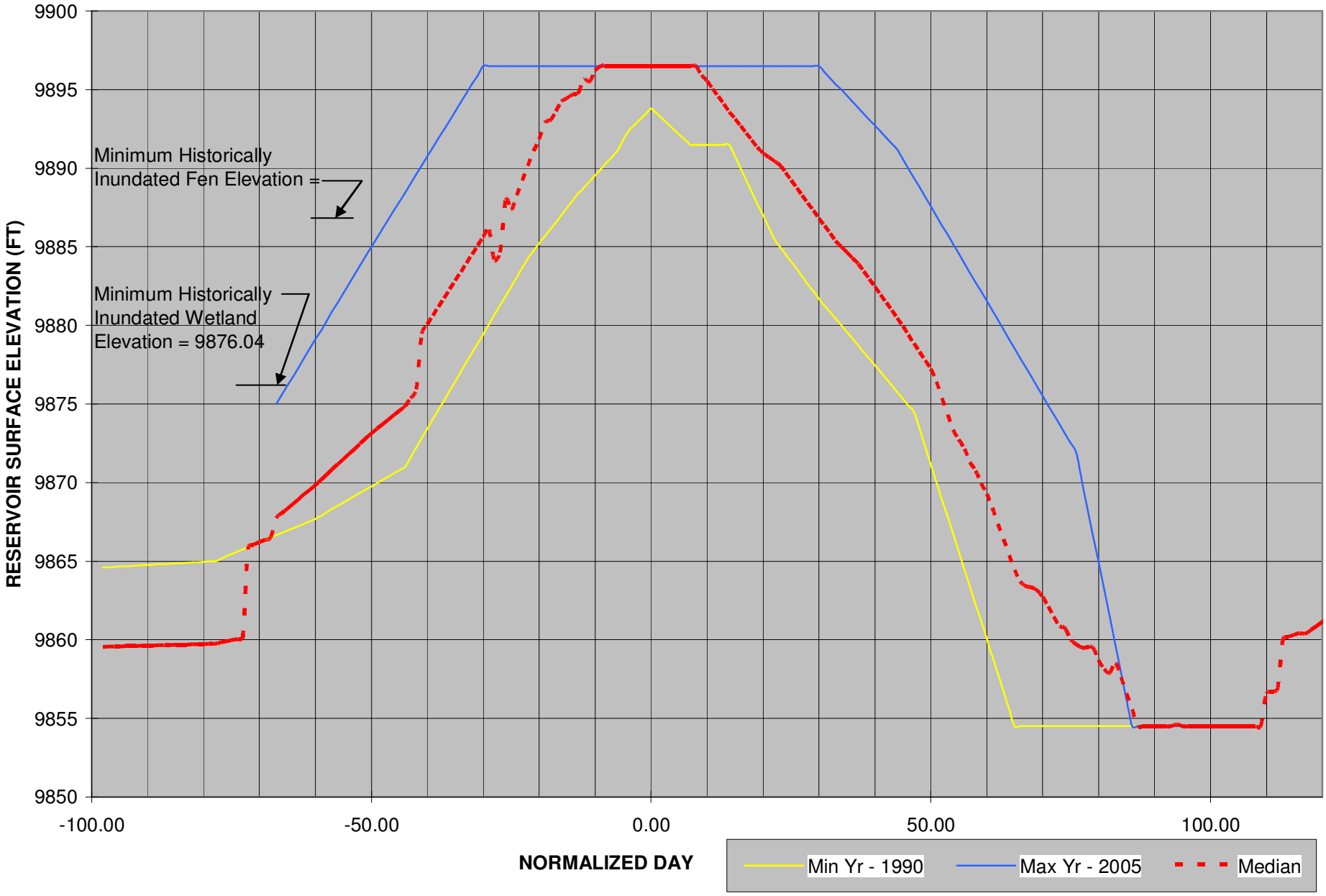
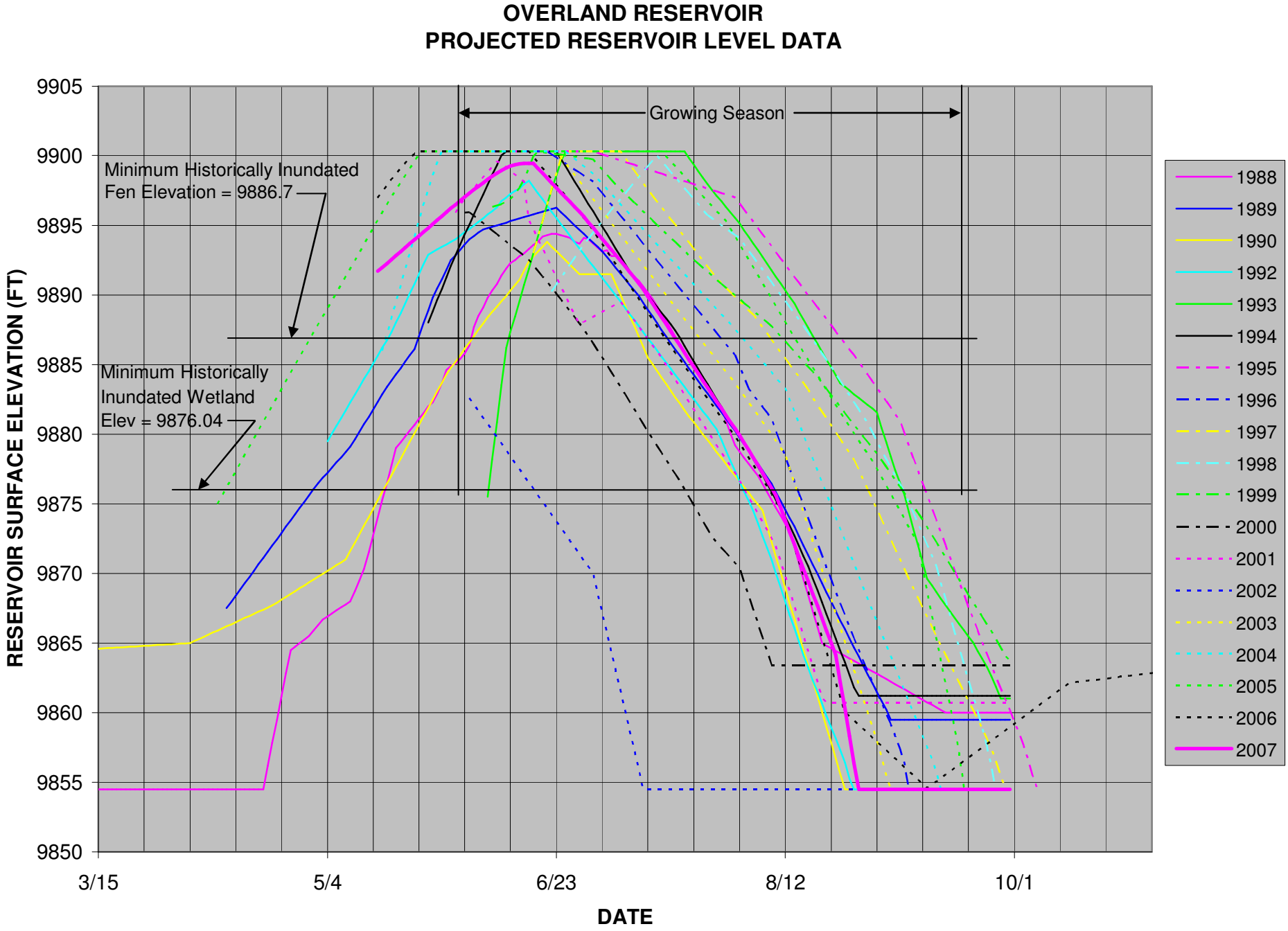
OVERLAND RESERVOIR
HISTORIC MINIMUM AND MAXIMUM FEN INUNDATION DURATION




OVERLAND RESERVOIR
PROJECTED RESERVOIR LEVEL DATA
Growing Season
Minimum Historically Inundated
Fen Elevation = 9886.7
Minimum Historically
Inundated Wetland
Elev = 9876.04
RESERVOIR SURFACE ELEVATION (FT)
9905
9900
9895
9890
9885
9880
9875
9870
9865
9860
9855
9850
3/15
5/4
6/23
8/12
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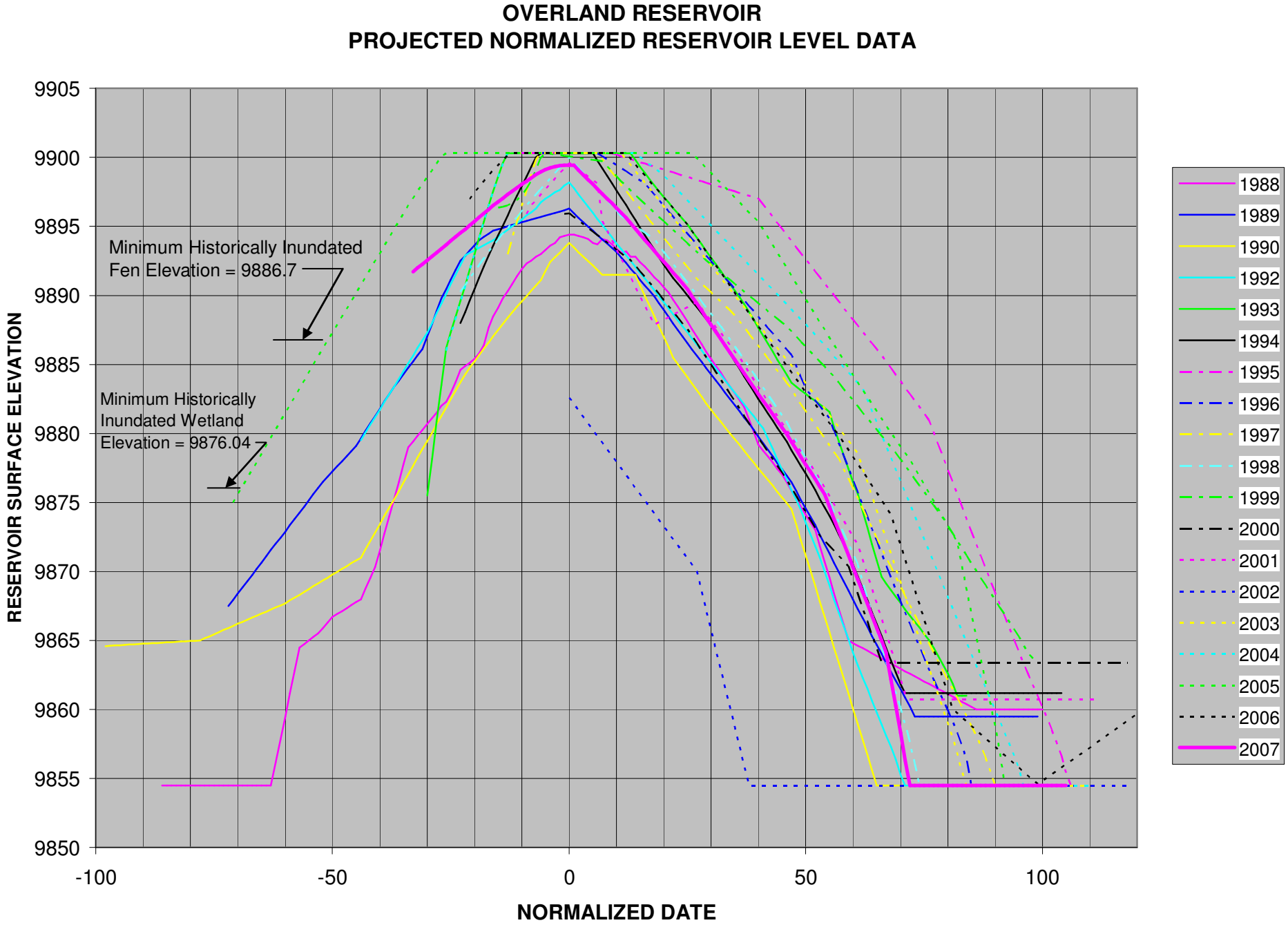
OVERLAND RESERVOIR
PROJECTED NORMALIZED RESERVOIR LEVEL DATA
RESERVOIR SURFACE ELEVATION
NORMALIZED DATE
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9895
9890
9885
9880
9875
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9860
9855
9850
-100
-50
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50
100
Minimum Historically Inundated Fen Elevation = 9886.7
Minimum Historically Inundated Wetland Elevation = 9876.04
1988
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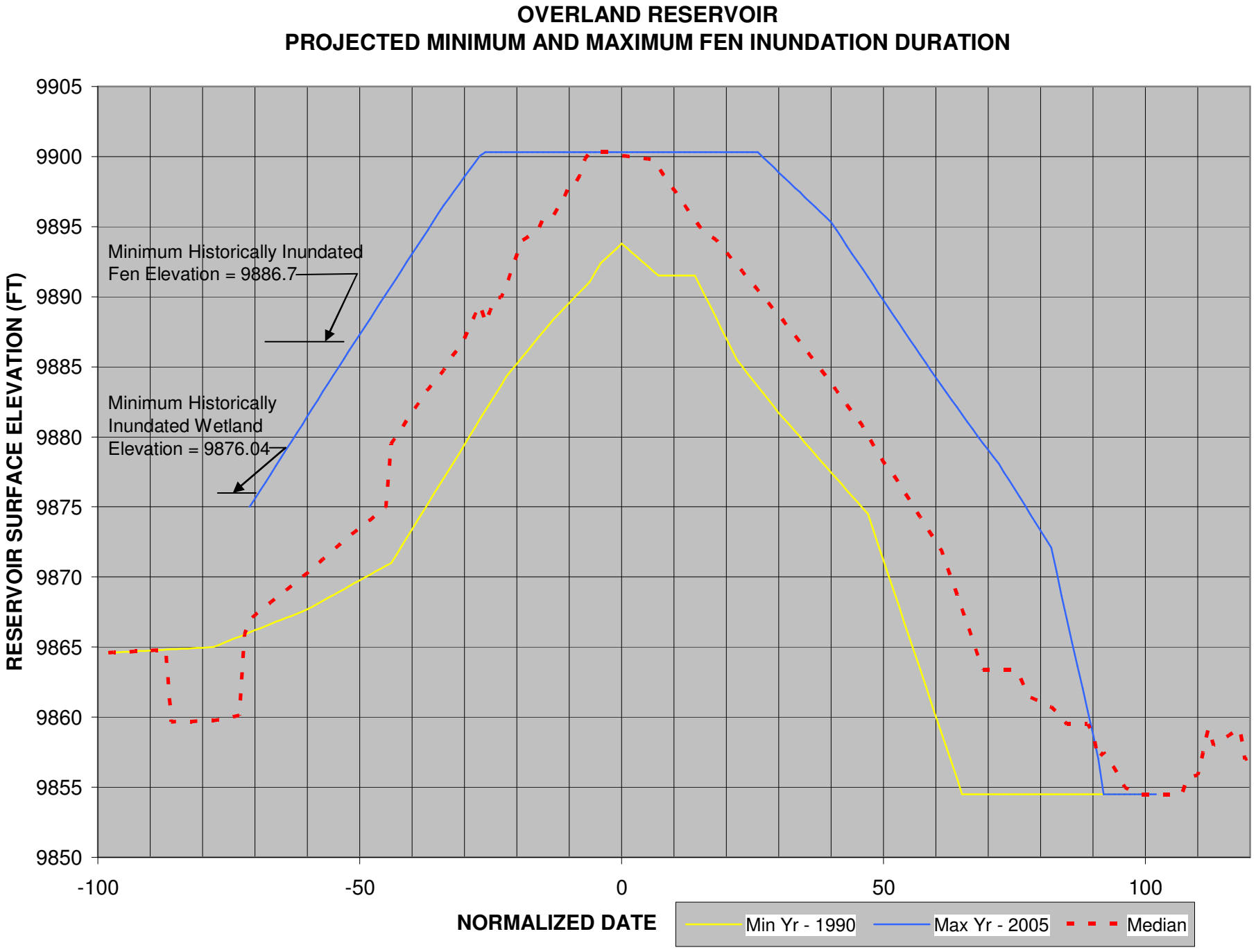
OVERLAND RESERVOIR
PROJECTED MINIMUM AND MAXIMUM FEN INUNDATION DURATION
RESERVOIR SURFACE ELEVATION (FT)
9905
9900
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9870
9865
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9855
9850
-100
-50
0
50
100
NORMALIZED DATE
Minimum Historically Inundated Fen Elevation = 9886.7
Minimum Historically Inundated Wetland Elevation = 9876.04
Min Yr - 1990
Max Yr - 2005
Median